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Market Power, Innovation and Financialization

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Summary

The present thesis has the ambition to jointly study two of the most invasive phenomena that shaped our economies over the last decades: financialization and the rise of information technology. The latter is strictly connected with innovation and economic progress but also to the pursuit of monopoly rents – as Schumpeter teaches, they are the main drivers of innovation – and the former can further contribute in shaping market power through additional rents. It has become clear that information technology advances have profoundly modeled nowadays economy, revolutionizing not only the way we work (new technologies entail higher productivities, the pandemic has legitimized massive smart-working forcing the digital transition, algorithms are new "bosses" in the Gig Economy to cite some examples), but also the way we consume (Big Data steal and address our consumption preferences, changing the nature of market power and rising privacy concerns) and the way workers' rights are reshaped (usually worsened, as in the case of food delivery and logistic in general). Returns from IT developments enrich big corporations operating in the IT sector, and their *Surplus Wealth* will be under analysis in the first chapter. Innovation, moreover, cannot be considered separately from financialization: M&A practices have been broadly studied, but in the last decades a new phenomenon has developed and deals with the accumulation of financial assets. The shift from profits stemming from firms' businesses to profits stemming from financial activities may have macroeconomic consequences that are still to be properly assessed. A recent report of the OECD, Çelik, Demirtas, and Isaksson (2020), provided some insights of the magnitude of this unfamiliar trend, which is ever increasing and popped up by low quality bonds. The study also confirms that non-financial companies have considerably engaged in bonds' holding/trading activities since 2009. In the attempt to provide some interesting insights on that, in the first chapter of this thesis, we present an empirical analysis concerning the link between financialization and monopoly power in the form of Surplus Wealth, (defined as the difference between wealth and capital – both tangible and intangible – employed). The first part of the chapter provides additional empirical support – at micro level – in favour of management shift towards shareholders' value orientation rather than growth. Increasing dividend payments and stock buybacks by influencing stock price expectations appear to be among the primary drivers of corporations' Surplus Wealth – together with R&D and advertising expenditure – especially for companies at the top of Surplus Wealth distribution – what we call monopolists– while profits derived from financial activities show some more robustness in results only in the 95^{th} percentile of the Surplus Wealth distribution. The panels have been constructed using WRDS Compustat database for the period 1970-2018

and comprehend active and inactive US non-financial corporations.

The second part of the analysis, consists of investigating corporations' investment behaviour when financial assets enter the decision making process. The holding/trading of marketable securities have no clear effect on capital investment: first, financial profits' positive impact on both physical capital and intangible capital investment appear to be at odds with existing literature, in particular with Orhangazi (2008); second, regressions' outcomes suggest the existence of a trade-off between current financial investment and current capital investment. Interestingly, such trade-off with tangible capital investment disappears for monopolists operating in the IT sector and turns positive concerning intangible capital investment. The stemming picture is of relevance for several reasons: firms detecting degrees of monopoly power are heavily engaged in the financing activity through the purchasing (and selling) of marketable securities and the accumulation of financial assets, which provides additional wealth. This fact should raise some concerns about (i) regulation and financial fragility, since non-financial corporations are partially acting as if they were financial firms (enjoying the non regulative framework) and their un-regulated activity may fuel unstable scenarios (in a bull market, higher financial profits may decrease the required margins of safety and enhance financial investments, both in good projects and in more risky ones. If interest rates increase, then the system may suffer from instability); (ii) competition, because financialization might have an important role in strengthening monopoly power by accruing additional wealth.

The second chapter theoretically addresses macroeconomic issues such as GDP fluctuations and employment over a business cycle when intangible capital investment are affected by innovation, and the potential rise of related wealth concentration mechanisms. The theoretical model has been settled in a macroeconomic agent-based environment, in order to look into the continuous interaction of these two main phenomena. If there exists a link between these two sources of wealth (innovation rents and financial rents) is still an open question. Macroeconomic agent-based models seemed the most suitable theoretical tool, given their flexibility in shaping behavioural decision rules in contexts of uncertainty. Starting with the CATS model[1], the credit market has been implemented with a market for bonds, where firms with some liquidity in excess can invest in both Government bonds and corporate bonds, issued by other firms, whose internal funds are not enough to carry production. Consumption-good firms need capital to be able to produce and capital takes the form of a firm level aggregator, in order to enable the coexistence of different types of capital (intangibles are assumed to have intrinsic advertising properties stemming from, for example, artificial intelligence). To introduce growth in a Schumpeterian framework in the model, some features of the K+S model[2] are introduced and implemented. By assumption, in the second chapter, innovation can be only related to intangible capital, whose quality impact on labor productivity. Results based on Monte Carlo simulation, where heterogeneous agents interact with each other through search and matching mechanisms, offer different insights. First, intangibles' holding can create some liquidity concentration in the hands of few consumption-good firms owning the most innovative capital

[1]Assenza, Delli Gatti, and Grazzini (2015)
[2]Dosi, Fagiolo, and Roventini (2010)

and in the hands of capital-goods producers at the frontier; bonds' holding however can contribute to more prolonged periods of liquidity accumulation also when the firm is no more at the frontier. Second, companies' engagement in the purchase of corporate bonds does not seem to be beneficial to technical progress and economic growth: almost all simulations display lower wages and increasing (but stable) unemployment rates. However, the nature of the experiments and the design of results yield to some considerations: (i) the negative effect on growth seems to depend on low levels of liquidity devoted to financial investments, so that there is less supply of credit than needed in the economy; (ii) increasing such fraction actually stimulates innovations through the finance-growth nexus, eliminating excess demand of credit, but negatively impact on bankruptcies, also increasing the share of Ponzi positions in the economy; (iii) a gap among firms' liquidity fraction to be invested in bonds bring us back to the negative scenario, because of credit rationing from the one side and the emergence of a trade-off effect among financial investments and capital investment on the other side.

Chapter 1

Financialization and Monopoly Surplus Wealth: An Empirical Study

1.1 Introduction

Over the past decades corporations have progressively increased their wealth, meanwhile going through a slowdown process of (tangible) capital accumulation. At the same time, the level of intangible capital has risen. At macro level those trends can explain income inequality, while at micro level they may shed some more light on market power and monopolistic competition. In a recent paper, Kurz (2017) addresses this issue of "additional wealth" consistently held by monopolistic companies through the lens of information technology (IT) proposing a linkage between monopoly rent (what he calls *Monopoly Surplus Wealth*) and IT driven businesses. Same sweet old question – i.e. "how much capital does [a firm] employ" and "how much wealth does it create for its owners" –[1], new answer: IT can generate monopoly rent, which shapes income distribution, contributing to the fall in the profit share and income share meanwhile fuelling the share of monopoly surplus income. Also J. Stiglitz, in his latest book *People, Power and Profits* addresses the new challenges brought about by IT and financial markets in our age, signed by the pursuit of market power, not captured by standard competitive models. He reports some quotes of the american magnate, Warren Buffet, who said: "The single most important decision in evaluating a business is pricing power. If you've got the power to raise prices without loosing business to a competitor, you've got a very good business"[2] and again "[We] think in terms of that moat and the ability to keep its width and its impossibility of being crossed. We tell our managers we want the moat widened every year"[3]. We argue that the moat can be thought as being a collection of rents coming from (i) the pursuit of innovation (mostly related to IT) and (ii) financialization mechanisms[4]. The issue in properly dealing

[1] Kurz (2017), page 2.

[2] Interview with the Financial Crisis Inquiry Commission, May 26, 2010. Reported in Stiglitz (2019), Ch.3, page 48

[3] See Dayen, "America's favourite monopolist". Reported by Stiglitz (2019), Ch.3, page 48

[4] A backward step: the word *financialization* is used to shape a phenomenon which took roots at the turn of the '70s-'80s in US and UK and whose boundaries and effects are still elusive, leaving the term itself orphan of a proper and complete definition. Broadly speaking, Epstein (2005) describes it as being *"the increasing role of*

with the latter phenomenon was (and still is) related to the difficulty in measuring it and brings about many methodological problems on how to evaluate evidence both at micro and macro levels. From the very beginning, however, financialization has been traced back to changes in firms' corporate governance structure, more and more influenced by shareholder activism which eventually brought firms to shareholder value orientation[5]). This preference channel, entails the fact that managers had progressively abandoned preferences for growth – and hence for long-term investment projects identified with capital expenditure – in favour of preferences for profits – and therefore for short-term (financial) investment and value creation mechanisms – aligning their interests with those of shareholders, who are concerned with higher dividends and increasing prices of the shares. Such an alignment has come also through changes in the wage structure that allowed for more variable components in the form of stock options (which push managers' attention towards stock price movements) and through the offering of junk bonds, which favoured the wave of hostile take-overs. To the best of our knowledge, most of the empirical studies on financialization, are done in a macroeconomic framework and a relevant part of the literature has found evidence of a negative impact on physical capital accumulation through increased management preference for short-termism (shareholders value orientation) on the one side and increased profits without (physical capital) investments which shape internal means of finance on the other side[6]. The challenge is now understanding if the accumulation of intangible capital suffers from financialization as well and, in particular, what is monopolists' behaviour. Our work suggests that financialization affects the Surplus Wealth measure and both tangible capital expenditure and intangible capital expenditure in the aggregate, whilst negative effects of financial assets almost vanish if we consider only monopolists. Further firms belonging to the $95th$ percentile of Surplus Wealth distribution and operating in the IT sector seem to benefit from financial investment in their R&D and advertising expenditure.

The chapter is organized as follows: Section 1.2 explicates the key concepts and the research questions, providing also the motivation behind them and revising the existing literature; Section 1.3 gives detailed information on the datasets' construction as well as their most interesting composition characteristics; Section 1.4 shows some empirical facts replicated by our datasets; Section 1.5 then goes through the first empirical analysis, which aims at understanding whether finanicalization variables are among the determinants of Surplus Wealth; Section 1.6 presents results for GMM regressions on investment, both in physical capital and in intangible capital.

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financial motives, financial markets, financial actors and financial institutions in the operation of the domestic and international economies" but the first attempts to address it can be traced back to the '90s, when Arrighi (1994) observes how increases in profits could not be only the result of firms' production activity, but also of the activity on financial markets.

[5](see Davis and Thompson (1994), Lazonick and O'Sullivan (2000) Fligstein (2002)

[6]See Stockhammer (2005), Hein and Van Treeck (2010) for a comprehensive discussion

1.2 Monopoly Surplus Wealth, Financialization, Investment and Related Literature

Pricing power still represents a challenging issue to economists: unobserved produced quantities make mark-ups' computation critical to be addressed empirically. Recently, a stream of academic papers tried to estimate and quantify mark-ups basically relying on Olley and Pakes (1992) and intuitions and estimation procedures (see De Loecker and Warzynski (2012), De Loecker and Eeckhout (2018), De Loecker, Eeckhout, and Unger (2020a), De Loecker, Eeckhout, and Mongey (2021)). Their estimated mark-ups are different from paper to paper, but give an overall picture of the trend in the US: mark-ups are increasing (on aggregate) from 1980 onward, with a rest (either a downfall either a zero growth trend) in the 2000-2010 decade and a recovery right after. The main drawback of this method concerns the use of a proxy for unobservable quantities produced in estimating the elasticity of output: individual firms' revenues are indeed deflated by a macroeconomic price indicator by sector (using NAICS 2 digits)[7]. Previous attempts to study market power and market concentration are related to the Tobin's q: Salinger (1984), for example, examines the long-run monopoly power by means of the Tobin's q measure; Gutiérrez and Philippon (2016) find out that high levels of Tobin's q did not drive capital investment, whose lack is, instead, justified by stock repurchase internal policies and decreased competition. About investment, Grullon, Hund, and Weston (2014) investigate the high investment-cash flow sensitivity of the top US capital spenders publicly traded firms arguing that the Tobin's q is a less accurate measure to capture such a sensitivity than current cash flow; while Peters and Taylor (2017) restores the investment-q relation by including intangibles in the definition of investment. In our attempt to investigate market power, we adopt a different approach by exploiting Kurz's measure of Surplus Wealth[8]: a considerable Surplus Wealth may be representative of monopolistic power, whose moat consists of barriers to entry due to IT and financialization, which enhance market value at the expense of capital investment. Information technology and innovations in the field of (Big) data collection and their use to expand business may represent a source of monopolistic rent that does not necessarily translate into excessively higher mark-ups but that can consistently increase firms' value (entailed in Surplus Wealth), making standard theory on monopolistic competition not sufficient to explain nowadays market power. Further, post-keynesians' key insight claims that the slowdown of (physical) capital accumulation has been driven by a shift in managerial targets from the pursue of long-term firm growth (capital investment) to short-term shareholders' value creation (again, what grows is Surplus Wealth). Given that managers – those who run the company – can be shareholders themselves, indeed, this objective alignment (value rather than growth) is easy to see. Basically, with managers' alignment to shareholders interests, the growth-profit trade-off lessens, being both agents – the owners and those who carry the company – engaged in enhancing profits,

[7]We attempt to estimate mark-ups following the mentioned procedures and results will be provided in Section C.3 of the Appendix.

[8]As will be later discussed, the measure of Surplus Wealth here employed, partially differs from the original one in Kurz (2017).

rather than growth. Stock-based compensation has been a tool through which such an alignment has been favoured; managers prefer short-term investments over long-term projects and physical capital accumulation (which in post-keynesian tradition is the company's driving force for long-term growth) looses importance. According to this view, "retain and invest" went past "downsize and distribute" internal policies, as claimed by Lazonick and O'Sullivan (2000). We need to check whether this is true also for intangible capital accumulation, which has been left out of the analysis so far. For example, Stockhammer (2008) relates some stylized facts with arguments on the finance-dominated accumulation regime[9], arguing that growth is affected by a collection of financial developments such as financial markets deregulation and liberalization of capital flows, increased financial markets' instability, management and corporate governance orientation towards shareholders interests and the invasion of different financial instruments, which affected firms' investment decisions and the increased access to credit related, for example to mortgages and properties used as collateral which shaped the behaviour of households, to cite some. Focusing on investment, he shows that, with some countries' exceptions, (tangible) capital investment as a percentage of operating surplus decreased in EU and US, ascribing this trend to the increasing importance of shareholders and claiming that, indeed, from a keynesian perspective, investment are mainly determined by future profit expectations rather than past realized profits. Van Treeck (2008b) uses a stock-flow consistent macroeconomic model to simulate the growing importance of shareholders' value orientation, also in the form of reduced equity issuance to finance production (in the form of physical investments). Results, however, are not clear-cut and strongly depend on different investment parameters' values. In this model, rentiers are fully associated with households: but if we are willing to assume that financialization – at least partly – shapes firms' activity and processes we have to take into account that companies act both as capitalists and as rentiers. Stockhammer (2004) recognises such duality but fails to address it in a satisfactory way. Contributions in the financialization literature also include Davis and Stout (1992), who proposed a pioneering study on the 1980's takeover wave focusing the attention on the change in managers' behaviour and Schaberg et al. (1999), who noted how the emergence of new financial instruments or tendencies (e.g. stock buyback) in UK did not necessarily impact on physical investment but on the market value of non-financial corporations. Krippner (2005) in addressing the financialization phenomenon in the US, defines the term "financial" as those "activities relating to the provision (or transfer) of liquid capital in expectation of future interest, dividends or capital gains"[10]. Her purpose is to understand economic change through what she calls an "accumulation-centred view" (i.e. by analysing the profit generation process). She shows that for both the financial and non-financial sector there has been an increase in income generated through financial activities with respect to that generated by the productive activity in the aggregate, over the period 1950-2001. For NFCs, the trend seems to be driven by manufacturing firms, which, in order to face negative cyclical events affecting profitability, rely on financial activities to compensate lower profits

[9]From a macroeconomic point of view, this expression wants to highlight the driving force of financialization in shaping the standard Keynesian expenditure function - i.e. aggregate demand, $Y = C + I + NX + G$

[10]Krippner (2005), Socio-Economic Review, page 174

coming from the productive activity. Finally Dünhaupt (2012) focuses on the fall in labor income share in US and Germany and tests its relationship with financialization econometrically. This paper has the merit to have made an attempt in finding the link between financialization and monopoly power[11], where the former shows off in the form of dividend payments and share buybacks, "downsize and distribute strategies", M&A, interest rates' variations or increasing indebtedness. Prior studies on dividend payments and mark-up can be found in Hein (2009) and Hein and Van Treeck (2010). Results are not clear-cut: wage income share is the only one that goes below its initial level (in 1970); retained earnings as a share of net national income remains quite constant, slightly increasing and rentier income share increases from the '80s to the end of the '90s but then decreases, not supporting the financialization hypothesis. However, the main force that drives rentier income share seems to be dividend income[12], providing some more support to the shareholder value orientation view. To our knowledge, there is just one paper on the effects of financialization at micro level: Orhangazi (2008) tries to empirically study how financialization affects investment in physical capital through two main channels: increasing payments to financial markets and profits stemming from financial investments. His main results tell us that (i) the first channel (financial payments) has a negative effect on investment in particular for large companies; (ii) the second channel (financial profits) decreases investment in capital stock for large companies but positively affects physical investment for small firms. Production is thus affected by corporations' investment in financial assets. Talking about investments also implies talking about risk and expectations. As Keynes put it: *"two types of risk affect the volume of investment which have not commonly been distinguished, but which it is important to distinguish. The first is the entrepreneur's or borrower's risk and arises out of doubts in his own minds to the probability of his actually earning the prospective yield for which he hopes. If a man is venturing his own money, this is the only risk which is relevant. but where a system of borrowing and lending exists, by which I mean the granting of loans with a margin of real or personal security, a second type of risk is relevant which we may call the lender's risk."*[13] Minsky's theory of investment captures exactly this idea: in his book, *Stabilizing an Unstable Economy*[14] he tries to theorize how the demand price for capital (i.e. the market price of existing capital assets[15]) lowers as the borrowers' risk increases and how its intersection with the supply price of new capital[16] (or price of investment goods), increasing with the lenders' risk, determines investment and the required level of external financing, given a certain level of internal funds. An increasing borrowers' risk reflects a higher failure exposure (i.e. a reduced borrowing power and a higher burden of debt over assets). A reduced borrowing power is translated into an increase in required Margins of Safety (MoS). Investment decisions crucially depend on expected cash flows generated (internal funds) and on expected flows of

[11]The determinants of the mark-up are here taken from Kalecki (1954): the degree of competition in the goods market, the development of overhead costs and the bargaining power of labor unions

[12]As compared to (i) interest income, (ii) property income attributed to insurance holders and (iii) rents, the other components of rentier income

[13]Keynes (1937), chapter 11.

[14]Minsky et al. (1986)

[15]Assenza, Delli Gatti, Gallegati, et al. (2010) assume it coincides with the stock price

[16]Assenza, Delli Gatti, Gallegati, et al. (2010) assumes it to be equal to the average price level

external financing. Each firm recurring to external finance to fund tangible or intangible capital investment is then a borrower. Each firm engaging in lending activities through the acquiring of financial assets, is also a lender and this last remark has already captured the attention of some academics as, for example, Villani (2021), Saibene (2019), Dao and Maggi (2018), Cesaroni, De Bonis, and Infante (2017) and Brufman, Martinez, and Artica (2013). Clearly, since *expected* flows are in place, a crucial role is played by uncertainty. When a non-financial company buys other companies' (or government) bonds or shares – which further directly broaden Surplus Wealth – future internal funds are expected to increase and this shift incorporates the lender's risk, which has been considered to affect only external funds so far. An element of risk, therefore, enters into funds available for future investment and financial networks arise also among non-banking companies, potentially enhancing the risk of financial fragility[17]. Financial fragility may appear exactly because, by lowering the required MoS, firms increasingly seek financial investment to generate additional future internal funds. Fragile schemes might be just around the corner: if an increasing number of borrowers is subject to indebtedness burden (higher overall debt over total assets or higher interest payments) a break may occur and the erosion of MoS among lenders cannot face the erosion of profits (due to borrowers' inability to face increasing financial commitments). The same issue can be re-shaped in neoclassical terms. Take Bernanke and Gertler (1989, 1990): investment at equilibrium is determined by the marginal productivity of capital (downward sloping) and the cost of funds, which is flat to the volume of internal fund and then increases according to the interest rate on debt (that incorporates risk). The "flat rate", is therefore associated with a risk-free rate. But when corporations chase additional internal funds through financial investments, we can no more consider the cost of internal funding as the opportunity cost of holding a safe asset. Redundant assets – i.e. marketable securities – entail lender's risk and internal fund is hence dependent on that. Duchin, Gilbert, Harford, and Hrdlicka (2017) have examined the composition of financial assets' portfolios, reporting the high percentage of risky assets. Assessing whether financial investment have an effect on tangible and/or intangible capital investment decisions, thus helps understanding whether firms have exposed each other to a new source of financial fragility and whether this additional risk is necessary for carrying the operating activity or to enhances monopoly rent. The main concern at macro level, which also corresponds to the motivation behind this chapter, is related to the financial stability of the entire system (left for future research). The collateral concern regards, instead, competition and market power and is the object of this study.

1.2.1 Surplus Wealth as Measure of Monopoly Power

The starting point for the current empirical study stems from the observation according to which "Monopoly Rent is capitalized by the market into *Monopoly Surplus Wealth*, which is the

[17] A higher Surplus Wealth is achievable – also – through higher financial investments, driven by lower required margins of safety. Lower margins of safety may enhance exposition to risk, fuelling a bull market: expectations of higher stock prices lowers the required MoS, which will favour investments (in general, not necessarily financial), but such a speculation goes beyond the scope of this chapter.

difference between *Capital* and *Wealth*"[18]. In the present chapter, we slightly depart from this original formulation by including intangible capital in the definition of *Capital Employed*. The issue of intangibles has been greatly debated: some are keen on considering it as part of capital, others are more prone to keep it apart from capital (see Hall (2001), Hansen, Heaton, and Li (2005), Hulten and Hao (2008), McGrattan (2017)). The argument is definitely controversial: to cite an example, internal developed patents can be considered as a form of capital that will be used in production, but at the same time they can be detected or sold in the form of licenses in order to limit competition. The latter use of intangibles, is therefore more related to wealth creation. However, let us assume that intangibles are a factor of production and that their non-competitive features are captured by Surplus Wealth, which is initially formally defined as in equation (1):

$$SurplusWealth = TotalWealth - Capital \tag{1.1}$$

and whose accounting equivalent is represented by equation (2)[19]:

$$SurplusWealth = ExcessMarketValue + RedundantAssets \tag{1.2}$$

where *RedundantAssets* comprehend financial assets, which therefore suggests the existence of a possible relationship between Surplus Wealth and financialization, inherent in listed companies' wealth. The question is then: why should a firm cumulate financial assets? The primary reason one can think of, is that financial investments can turn back additional revenues in the form of interests, dividends and capital gains. Financial investments themselves do not contribute directly to production (like investments in fixed capital or R&D) but the additional revenues they generate may partly be used as internal funds for growth purposes tomorrow: by expanding their internal funds through financial revenues companies are introducing an element of risk in their investment function and if financial fragility arises in the system, companies holding financial assets may be touched by instability and their internal funds could suffer. To cite some examples about the scale of the phenomenon, in 2017 Apple's asset side in the balance sheet was composed by 66% of financial assets (they were 3% in 1995 and grew dramatically up to 41% in 2005); Microsoft held 54% of assets in financial assets and Facebook 40%. Duchin, Gilbert, Harford, and Hrdlicka (2017) found out that companies' "cash and cash equivalents" measure is composed, on average by 23,2% of risky assets, which raise to 38,3% when considering aggregate financial asset portfolios (where corporate debt and equity account for the 23,6% and 8,6% respectively). Short-term investments (the "cash equivalents" component of the cited measure), therefore, include a consistent percentage of risky securities and among them, 79% are, in reality, illiquid (not properly a cash equivalent). So, by holding more financial assets, companies can increase their wealth but at the expenses of internal funds' exposure to risk. A second observation – which will be developed in this chapter – pertains the strategic linkage

[18] Kurz (2017), page 1.

[19] To give some insights on the logic behind the two equations, please note that $ExcessMarketValue = MarketValue - NetWorth$ and $Capital = TotalAssets - RedundantAssets$. For complete details about accounting manipulations, please refer to Kurz (2017), page 4.

between financial profits and capital accumulation: given the slowdown in tangible capital accumulation, and the increase in intangible capital accumulation, we can assume that market power lies in the latter form of capital and therefore that some proceeds from financial investments, by lessening the financing constraint, may be devoted to more strategic operations such as M&A, R&D expenditure, advertising or branding expenditure, buy licenses, face patent infringements etc. This does not mean that higher internal funds necessarily translates into substantially greater R&D investment (and hence further drastic innovation and growth) for monopolists: it only suggests that they might employ those additional profits in a sufficient amount to maintain their market position through intangibles and related monopoly rents (and not massively to pursue growth), since we assume the inverted U relationship between market power and R&D to hold (see Aghion, Bloom, Blundell, Griffith, and Howitt (2005)).

A second reason of holding financial assets relates to the fact that a fraction of financial profits might, instead, be re-invested in other securities – thus favouring further financial capital accumulation – and/or can be devoted to other strategic operations that enhance the market value of a company (i.e. the payment of dividends to shareholders or the repurchase of shares to make some examples) and hence monopoly Surplus Wealth in case of firms with market power. In general, this might be done at the expense of growth: companies might face a trade-off in deciding how much to invest in capital (whether tangible or intangible) and how much to invest in financial assets and we expect this trade-off (if any) to be more relevant for competitive firms rather than for monopolists. One last observation: holding consistent financial assets (and thus making massive investments in marketable securities, whether short-term or long-term) also means that the corporation basically partially operates as a bank, giving other companies the liquidity they need to carry their business projects (remember that corporate debts represent the 23% of risky financial asset portfolios according to Duchin, Gilbert, Harford, and Hrdlicka (2017)) and it should rise some regulations' concerns.

Until now we have explicited the endogenous but indirect effect of financialization on Surplus Wealth (i.e. proceeds coming from financial investments that serve also for value purposes, rather than only growth purposes). The direct effect of financialization on Surplus Wealth, however, passes directly through its Excess Market Value component taking the explicit form of shareholders' value orientation previously introduced and that will be addressed in detail in Section 1.5. The concerns regarding the measure of Surplus Wealth can be deducible from Figure 1.1, that shows the distribution of Surplus Wealth among US non-financial companies in 2018. The picture is striking in highlighting the great detention of Surplus Wealth "in the hands" of few firms: the 99*th* percentile is occupied by only 20 listed companies (reported in Table 1.1). This feature suggests that inference that does not take into account such differences in the distribution on Surplus Wealth (i.e. using the representative firm) may also not take into account the different investing and financing behaviour of corporations, which will eventually shape aggregate investment and, potentially, financial fragility. This observation is the rationale for the construction of three different samples to carry the empirical analysis (as explained in details in section 1.3) and will allow for a departure from perfect competition in light of the assumption that monopolistic firms can behave differently.

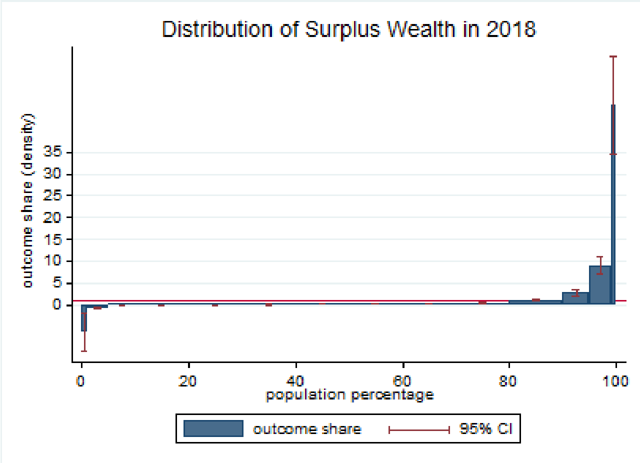


Figure 1.1: **Distribution of Surplus Wealth in 2018. Author's calculations on WRDS Compustat data.**

Table 1.1: **List of firms belonging to the 99^{th} Percentile of wealthiest companies in 2018 ranked according to their Surplus Wealth, from the highest value to the lowest one, and their IT classification.**

Company Name	Surplus Wealth	IT status
APPLE INC	1101798.00	IT
MICROSOFT CORP	746264.88	IT
AMAZON.COM INC	671142.38	IT
ALPHABET INC	677356.50	IT
JOHNSON & JOHNSON	254280.80	partially IT
HOME DEPOT INC	195578.78	non-IT
COCA-COLA CO	194305.63	non-IT
PFIZER INC	173226.36	partially IT
CISCO SYSTEMS	173017.38	IT
NESTLE SA/AG	172108.63	non-IT
ROCHE HOLDING AG	170898.17	partially IT
BOEING CO	163060.20	partially IT
MERCK & CO	161826.06	partially IT
WALMART INCO	150814.22	non-IT
ORACLE CORP	142434.23	IT
MCDONALD'S CORP	136889.73	non-IT
PEPSICO INC	129770.60	non-IT
INTEL CORP	129030.94	IT
TAIWAN SEMICONDUCTOR MFG CO	127823.73	IT
PROCTER & GAMBLE CO	126932.47	non-IT

In what follows we try to address two main research questions:

1. What are the determinants of *Surplus Wealth*? In particular, does financialization directly contribute to the creation and detection of firms' market power?

2. How is investment behaviour affected by financialization and the accumulation of financial assets? Is there a trade-off effect between financial investment (in particular, short-term financial investment, which are possibly motivated by speculative reasons, given their risky composition and their short-termism) and investment in tangible and/or intangible capital? Most importantly, is there a liaison between financial rents and monopoly rents?

1.3 Data

The entire sample has been crated using WRDS Compustat annual, database for the fiscal period 1970-2018. The analysis is focused on US active and inactive non-financial companies (hence, SIC codes 6000-6799 are excluded as well as SIC codes from 9100 and SIC codes 4800-4999) and comprehends those firms (i) with available global company key and fiscal year; (ii) with non-negative values for total assets, total liabilities, sales and cost of good sold, capital expenditure, R&D expenditure, advertising expenditure, dividend payments and issuance of new shares/bonds and (iii) whose market value can be calculated[20]. Missing values have been replaced by zeros and companies with less than 10 consecutive years of observations have not been considered. Entry and exit over the time span considered led to unbalanced panels. The list of variables is reported below, while summary statistics can be found in section A.1 of the Appendix:

- *Surplus Wealth* ($SW_{i,t}$): can be either calculated using eq.(1.1) or eq.(1.2), since both yield the same outcome. Following Kurz (2017), in the calculation of $Total\ Wealth$ and $Excess\ Market\ Value$, we have multiplied firms' total assets by the ratio of (aggregate) current-to-historical total assets values reported in Table B.103 of Z.1 (Financial Accounts of the United States) available at Federalreserve.gov, to purge total assets from land value (already embodied in equity prices)[21].

- *Sales*, ($SALES_{i,t}$): corresponds to the Compustat item *sale* and, apart from giving information on firms' turnover, can also be considered as a proxy for size.

- *Leverage*, ($LEV_{i,t}$): is simply calculated as total liabilities divided by total assets.

- $Tobin's\ Q$, ($TobinQ_{i,t}$): in the form of market value plus total liabilities (book value) over total assets (book value), as in Brufman, Martinez, and Artica (2013) and Villani (2021).

- *Labor productivity* ($Lprod_{i,t}$): we tried to calculate labor productivity at firm level by using deflated total production (as the sum of sales and inventories – both finished goods and work in progress) as a proxy for quantities produced[22] and dividing it by the number of employees reported on Compustat. Given that the deflator is a macroeconomic indicator (more in detail, we have used the chain-type price indexes for value added by industry – using NAICS codes – provided by BEA), this measure of labor productivity is very rough and is used as a proxy with reserve.

- *Acquisitions* ($ACQ_{i,t}$): dummy variable that takes value 1 if the firm has a strictly positive value corresponding to the observation provided by Compustat item *aqc* in any given year and zero otherwise.

[20]Market Value on WRDS Compustat is available, but only from 1998. There are some discrepancies among the Market Value item values – mkvalt – and those computed by multiplying the number of outstanding shares – csho – by the closing price, fiscal – prcc_f, and therefore I have corrected those discrepancies using computed data in order to ensure consistency with data before 1998.

[21]See Kurz (2017) for a detailed explanation of the rationale behind such adjustment

[22]We will discuss more on the use of deflated sales as a proxy for quantities in section C.3 of the Appendix.

- *Dividend payments* ($DIV_{i,t}$): Compustat item *dv*.

- *Repurchase of own stocks* ($BUYBACK_{i,t}$): Compustat item *prstkc*.

- *Market financing* ($MKT\ FINANCE_{i,t}$): is the sum of newly issued stocks (Compustat item *sstk*) and newly issued bonds (Compustat item *dltis*) and represents the amount of external finance that a firm ask to the market.

- *Financial profits* ($\pi_{i,t}^{fin}$): are interests and dividends income, Compustat item *idit*.

- *Investment in tangible capital* ($I_{i,t}^{\kappa}$): is capital expenditure in its usual sense, Compustat item *capx*.

- *Investment in intangible capital* ($I_{i,t}^{intan}$): is the sum of R&D expenditure (Compustat item *xrd*) and advertising expenses (Compustat item *xad*), and is here used as a proxy for intangible expenditure.

- *Long − term debt* ($DEBT_{i,t}$): Compustat item *dltt*.

- *Financial payments* ($PAY_{i,t}^{fin}$): is a proxy for cash commitments to financial markets plus stock repurchase and can be obtained by summing dividends paid plus interest and related expense (Compustat item *xint*) and stock buybacks.

- *Redundant assets* ($RED_{i,t}$): corresponds exactly to *financial assets*, which is calculated by summing Investment and Advances (Compustat items *ivaeq* and *ivao*) and Short Term Investment (Compustat item *ivst*). It is a stock measure.

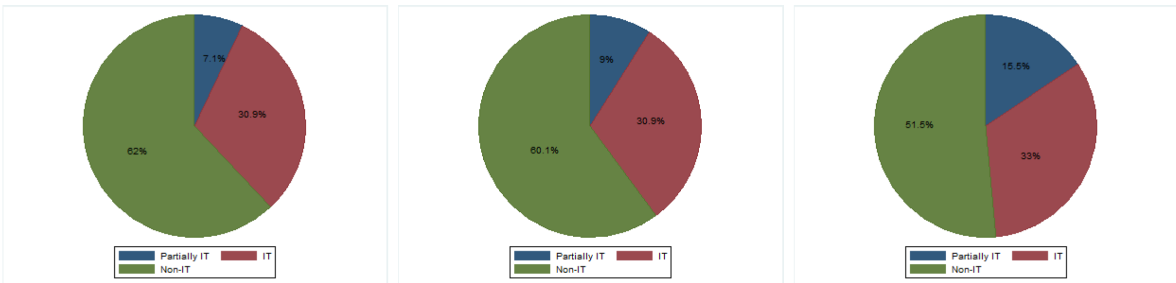
- *Short−term fianncial investment* ($s.t.\ I_{i,t}^{fin}$): only corresponds to Compustat item *ivst*, which is also the cash equivalent component of *Cash and Cash Equivalents*.

- *IT belonging* (χ_i): is time invariant and can take only 3 values. This step required associating each sector to the level of IT business of the sector/industry using GICS codes. The procedure to do so consisted of creating a variable χ and assigning it different values corresponding to the degree of IT business of each firm. To this extent we assigned value $\chi = 1$ (i.e. the firm operates in the IT sector) to Data Processing Services; Media; Internet and Direct Marketing Retail; Health Care Technology; Biotechnology; Capital Markets; Financial Exchanges & Data; Mortgage REITs; Information Technology; Communication Services and Real Estate; value $\chi = 0.5$ (i.e.the firm operates in a sector which has been partially transformed by IT) to Aerospace & Defense; Education Services; Health Care Services; Pharmaceuticals; Life Sciences Tools and Services and $\chi = 0$ (the firm does not operate in the IT sector) for the remaining sectors.

All variables but dummy variables used in the Surplus Wealth analysis in section 1.5 are then standardized and will have an "s" before indicating standardization, whilst lower case typed variables in the investment analysis section 1.6 will indicate their logarithmic transformation.

Before turning into logs, variables have been divided by total assets to correct for heteroskedasticity and nominal variables included in the regression have been deflated by the GDP price index (except for investment in tangible capital that has been adjusted by the investment goods price index).

Three different panel are then constructed: (1) the *representative sample*, purged from outliers according to the two-step procedure followed by Orhangazi (2008))[23] and assumed to be representative of the economy as a whole; (2) the *Q2 sample*, not purged from outliers and containing all companies belonging to the 2*nd* quartile of the distribution of Surplus Wealth and (3) the *P95 sample* that can be considered a subsample of the *Q2 sample* and collects all companies in the 95*th* percentile of the distribution of Surplus Wealth, where monopolists lie, as shown in Figure 1.1 and Table 1.1 (where only companies belonging to the 99^{th} percentile are reported). As one can easily notice from Table 1.1, 8 of the wealthiest firms in terms of Surplus Wealth operate in fully transformed IT sectors (χ=1) and 13 out of 20 of them belong to at least partially transformed IT sectors (χ=0.5 and χ=1), which is more than the half. Keeping this in mind, we can now observe the distribution of companies operating in the IT sector in 2018 in our three different samples, as illustrated in Figure 1.2:



(a) Representative sample (b) Q2 sample (c) P95 sample

Figure 1.2: **Companies' IT distribution in 2018, in the representative sample (panel (a)), in the Q2 sample (panel (b)) and in the P95 sample (panel (c)). Author's computations according to GICS.**

In all samples, the majority of firms belongs to the Non-IT sector (62% in the *representative sample*, 60,1% in the *Q2 sample* and 51,5% in the *P95 sample*) and we can observe that the percentage of US firms operating at least in a partially transformed IT sector increases as we consider outliers and restrict the sample for higher Surplus Wealth (Figure 1.2b, 1.2c), reaching nearly half of the pie in the monopolists' sample (*P*95 *sample*). As a matter of fact, the evolution of IT firms' distribution over time (not reported) confirms the trend towards a more IT transformed economy: the total of companies operating in partially-IT and IT sectors was only the 15,2% in 1970 (*representative sample*); while it grew to 33,1% in 1995, going close to 40% in 2018.

Finally, a general picture of firms' distribution by sector is provided in Figure 1.3, which is referred to the *representative sample*, but is similar for the other two samples (not reported in figure):

[23]First firm variables' means are calculated and then dropped if below the 1^{st} percentile or above the 99^{th} percentile.

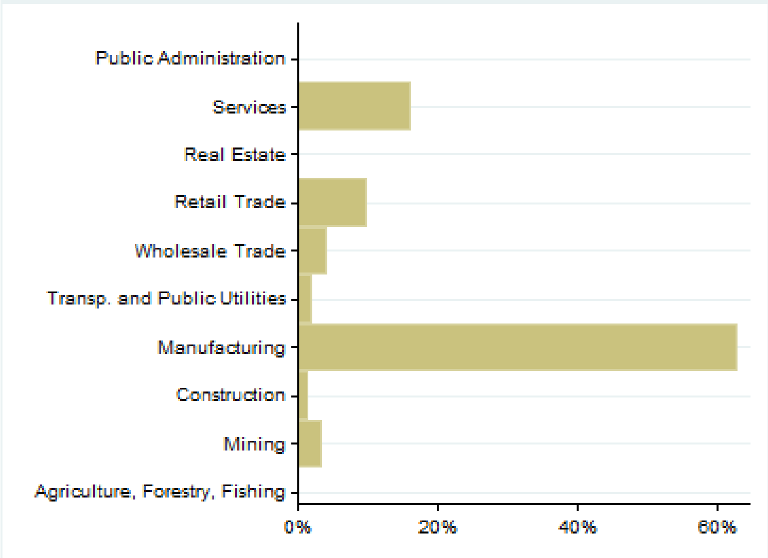


Figure 1.3: **Companies' Distribution by sector, SIC 2 digits code, representative sample.**

The *representative sample* is mainly composed of manufacturing firms (more than 60% of the total; it is 59% in the *Q2 sample* and 67% in the *P95 sample*), followed by services (around 20%, also in the *Q2 sample* and 13% in the *P95 sample*) and retail trade (10% in the *representative sample* and in the *P95 sample* and 8% in the *Q2 sample*). The distribution among the remaining sectors is almost homogeneous.

1.4 Some Empirical Facts

Figure 1.4 shows the average Surplus Wealth on the entire sample over time: the increasing trend stopped right after 2000 and fully recovered with an unprecedented spike only after 2010, after the dramatic downfall in 2008 (probably due to the financial crisis).

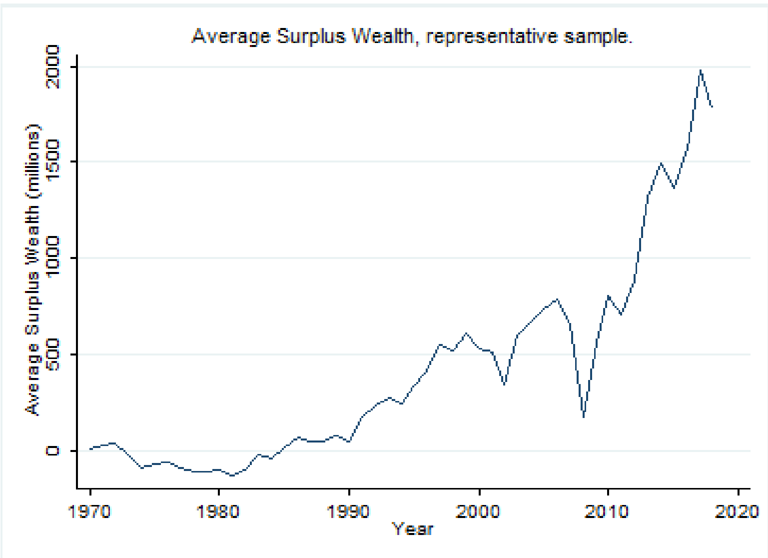


Figure 1.4: **Average Surplus Wealth (millions of dollars) from 1970 to 2018. Representative sample.**

If we plot the same graph for all samples in the same scale (Figure 1.5) we can notice two main features: (i) all trends are increasing and have the same turning points (ii) the scaling difference on the y axis is absolutely shocking: firms belonging to the 95^{th} percentile of the distribution have extremely high values of Surplus Wealth – which we call monopoly Surplus Wealth – and such magnitudes are not captured by neither the representative sample, neither the Q2 sample.

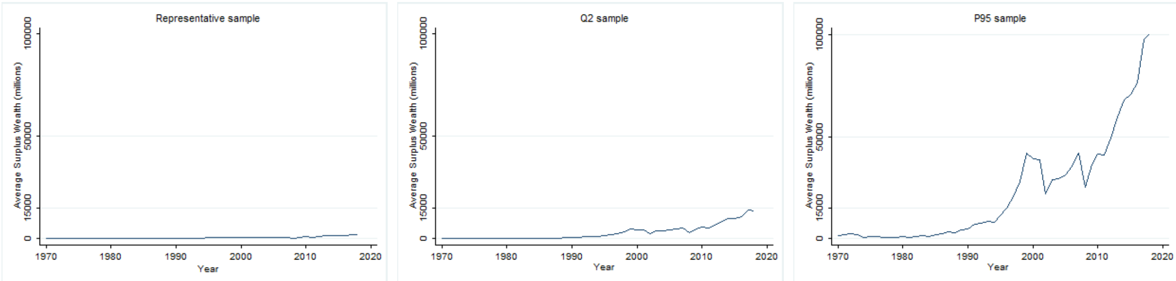


Figure 1.5: **Average Surplus Wealth (millions of dollars) from 1970 to 2018 in the representative sample (left), Q2 sample (center) and P95 sample (right) in the same scale.**

If we decompose Surplus Wealth and observe the evolution of financial assets, we can notice that, whilst the *representative sample* does not show particular similarities in the two trends (Figure 1.4 vs. Figure 1.6 top left panel), the *95 sample* displays the same drastic increase after the 2008 fall (Figure 1.5 right panel vs. Figure 1.6 top right panel). Again, the value of average financial assets held by firms in the *representative sample* shows huge differences with the *Q2 sample* and the *P95 sample* (Figure 1.6, top panels) and the same is remarkable also for short-term financial investment (Figure 1.6, bottom panels). A correlation table is also provided in order to show the different relationships between short-term investment and the two dependent variables questioned in Section 1.6: Table 1.2 highlights a strong discrepancy between the correlation of intangible investment and short-term financial investment among the different samples, in particular between the *representative sample* – where the correlation is of 24% – and the *Q2 sample* and the *P95 sample* – where the correlations are up to 57% and 55%, respectively – whilst the correlations of tangible capital investment and short-term financial investment do not diverge that much in the different samples.

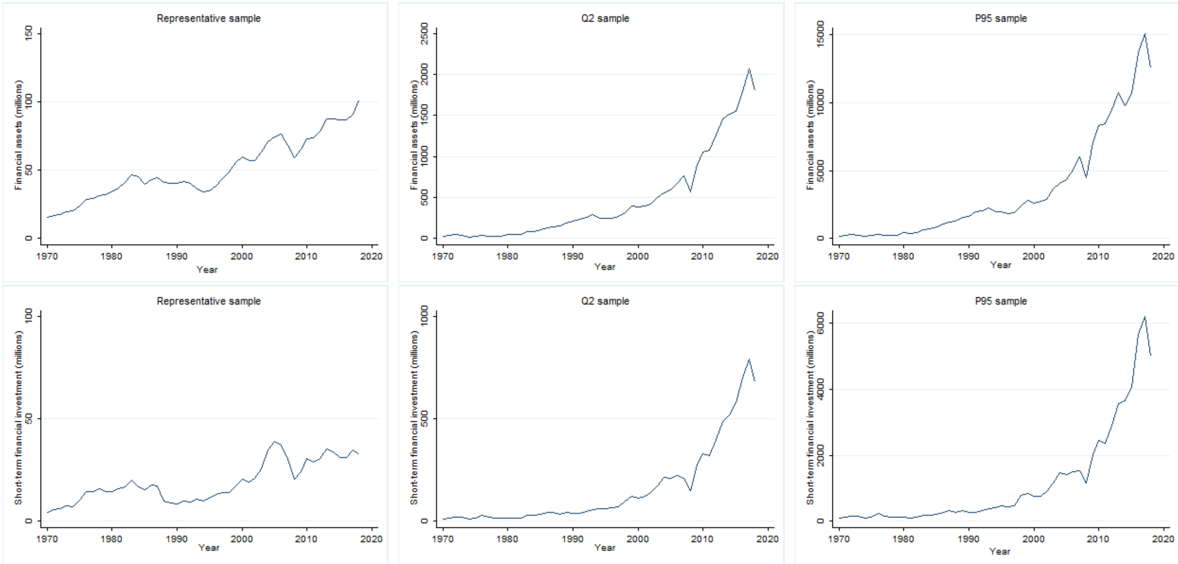


Figure 1.6: **Financial assets held by companies over time (top panels) and their short-term financial investment (bottom panels). Representative sample (left), Q2 sample (center) and P95 sample (right).**

Table 1.2: **Correlation matrix for tangible capital investment, intangible investment and short-term financial investment.**

	Representative sample			Q2 sample			P95 sample		
	I^{κ}	I^{intan}	$s.t.\ I^{fin}$	I^{κ}	I^{intan}	$s.t.\ I^{fin}$	I^{κ}	I^{intan}	$s.t.\ I^{fin}$
I^{κ}	1			1			1		
I^{intan}	0.36	1		0.42	1		0.33	1	
$s.t. I^{fin}$	0.20	0.24	1	0.27	0.57	1	0.22	0.55	1

Figure 1.7, instead, shows the average slowdown of capital accumulation: the downward trend is quite similar in the *representative sample* and in the *Q2 sample* (left and central) – confirming well known macroeconomic stylized facts – while it exhibits much more volatility in the *P95 sample* (right). Figure 1.8, illustrates the opposite trend of average intangible assets held by companies as a percentage of total assets. Although the upward trend is a common feature in all samples, companies in the *representative sample* hold 21,2% of assets in intangibles in 2018 (left), while if we consider only firms with a Surplus Wealth above the median, they hold 27,2% of assets in knowledge or patents (central); while companies belonging to the 95^{th} percentile the 30,5% (right). The role of intangibles has increased over time and nowadays it is not only referable to the fight for patents. A lot of intangible value comes also from the brand itself (and related monetary efforts – marketing, advertising –) and is also strictly related to the IT sector development. Think about Big Data collection: as Stiglitz puts it "*The existence of technology giants' market power is seen most dramatically every time Facebook changes its algorithms, the way it determines what individual see and in what order. A new algorithm can bring on the quick decline of a media outlet, or can create, and then possibly end, new ways of reaching large audiences (as in Facebook Live)*"[24].

[24]Stiglitz (2019), page 124.

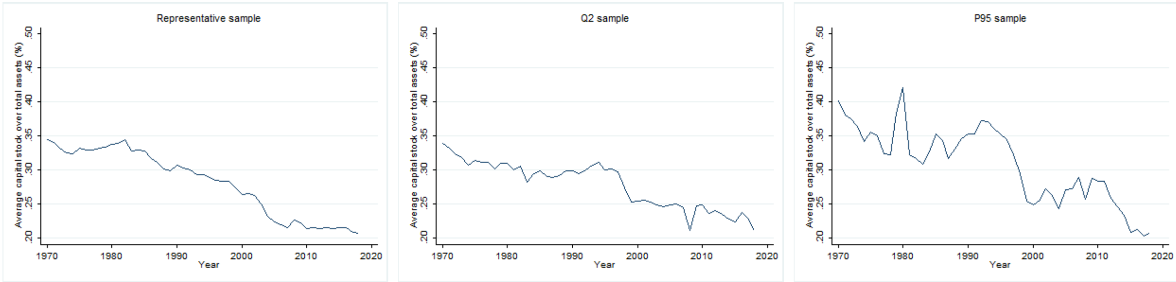


Figure 1.7: **Average (tangible) capital stock as a percentage of total assets over time. Representative sample (left), Q2 sample (center) and P95 sample (right).**

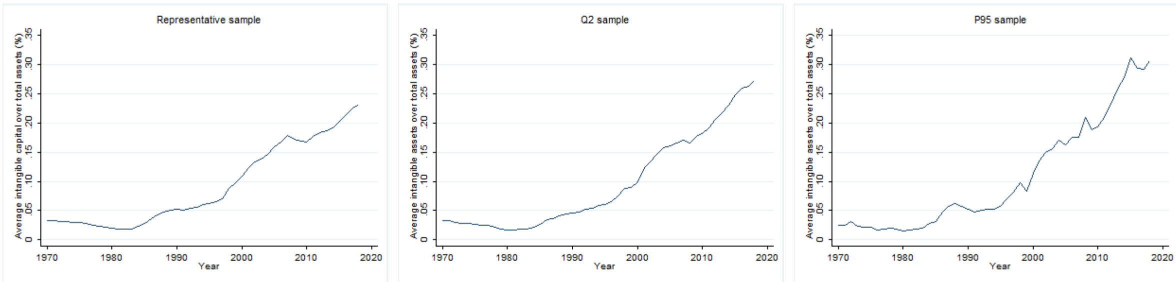


Figure 1.8: **Average intangible capital stock as a percentage of total assets over time. Representative sample (left), Q2 sample (center) and P95 sample (right).**

1.5 Analysis on Surplus Wealth

1.5.1 Surplus Wealth: Econometric Specification

We try to econometrically address the first research question by using in our specification model a set of control variables (sales, leverage, Tobin's q and labor productivity), a proxy for intangible investment and a set of financialization variables (which include acquisitions, dividend payments, stock buyback, new issuance of stocks and bonds and financial profits). The complete specification is the following:

$$\begin{aligned} sSW_{i,t} =& \alpha + \beta_1 sSALES_{i,t} + \beta_2 sLEV_{i,t} + \beta_3 sTobinQ_{i,t} + \beta_4 sLprod_{i,t} \\ &+ \beta_5 sI^{intan}_{i,t} + \beta_6 ACQ_{i,t} + \beta_7 sDIV_{i,t} + \beta_8 sBUYBACK_{i,t} \\ &+ \beta_9 sMKT\ FINANCE_{i,t} + \beta_{10} s\pi^{fin}_{i,t} + c_i + \rho_t + v_{i,t} \end{aligned} \tag{1.3}$$

which is a fixed-effect model accounting for individual-specific unobserved heterogeneity, c_i, and time fixed-effect ρ_t, and with $v_{i,t} \sim IID(0, \sigma_v^2)$, being the idiosyncratic error term. Each variable but the dummy $ACQ_{i,t}$ has been standardized and is at time t because the dependent variable is not the outcome of a decision process (like, for example investment): we are just checking period determinants of current Surplus Wealth, assuming that it entails monopoly power for those firms at the very top of the distribution.

1.5.2 Surplus Wealth: Estimated Results

Table 1.3 shows results for the *representative sample*: financialization variables seem to have a positive and very significant impact on companies' Surplus Wealth as well as sales, intangibles' expenditure and the Tobin's q; while leverage has a significant negative effect and labor productivity seems to play no role.

Table 1.3: **Fixed-effect regression of Surplus Wealth on sales, leverage, Tobin's q, labor productivity, acquisitions, intangibles' proxy, dividends paid, buybacks, newly issued stocks and bonds and financial profits. All variables but dummies standardized. Period 1970-2018. Representative sample.**

	Representative sample							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t
$sSALES_t$	0.344***	0.191***	0.343***	0.180***	0.323***	0.328***	0.169***	0.0777
	(0.0719)	(0.0670)	(0.0719)	(0.0581)	(0.0717)	(0.0717)	(0.0584)	(0.0567)
$sLEV_t$	-0.0349***	-0.0393***	-0.0346***	-0.0382***	-0.0373***	-0.0344***	-0.0383***	-0.0407***
	(0.0129)	(0.0127)	(0.0130)	(0.0118)	(0.0127)	(0.0131)	(0.0119)	(0.0120)
$sTobinQ_t$	0.178***	0.184***	0.178***	0.169***	0.179***	0.179***	0.170***	0.175***
	(0.0223)	(0.0232)	(0.0223)	(0.0212)	(0.0224)	(0.0224)	(0.0213)	(0.0221)
$sLprod_t$	0.00183	-0.00259	0.00237	0.00324	0.00236	0.00165	0.00365	-0.000275
	(0.00638)	(0.00468)	(0.00648)	(0.00618)	(0.00639)	(0.00634)	(0.00627)	(0.00462)
sI_t^{intan}		0.336***						0.268***
		(0.0619)						(0.0576)
ACQ_t			0.0378**				0.0282**	0.0198
			(0.0156)				(0.0131)	(0.0127)
$sDIV_t$				0.219***			0.216***	0.195***
				(0.0531)			(0.0527)	(0.0491)
$sBUYBACK_t$				0.183***			0.180***	0.162***
				(0.0325)			(0.0325)	(0.0298)
$sMKT\ FINANCE_t$					0.0569**		0.0136	-0.00998
					(0.0225)		(0.0217)	(0.0240)
$s\pi_t^{fin}$						0.0653***	0.0348	0.0102
						(0.0232)	(0.0215)	(0.0183)
N. obs.	55768	55768	55768	55768	55768	55768	55768	55768
N. firms	2256	2256	2256	2256	2256	2256	2256	2256
R^2 *within*	0.208	0.267	0.209	0.302	0.212	0.212	0.304	0.339
R^2 *between*	0.230	0.390	0.234	0.432	0.236	0.246	0.438	0.518
R^2 *overall*	0.216	0.315	0.218	0.362	0.221	0.224	0.365	0.415
Adj. R^2	0.208	0.266	0.208	0.302	0.211	0.211	0.304	0.338
$Time\ fixed\ eff.$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Focusing on financialization variables, we can notice the major contribution brought by dividends payments, $sDIV_t$, and stock buyback, $sBUYBACK_t$, to Surplus Wealth: the standardized coefficient -significant at the 1% level- ranges from 0.195 to 0.219 for the former and from 0.162 to 0.183 for the latter in all specifications (columns (4), (7), (8))[25] and that they are higher than the coefficient of standardized sales. Additionally, specifications includ-

[25]Since we are dealing with standardized variables (with mean=0 and sd=1), in order to compute the effect on the unstandardized variable, SW, we have to multiply the standardized beta for SW standard deviation (which can be found in Table3)

ing dividends payments and buybacks are also those which can explain the greatest portion of variation in the dependent variable among all specifications considered: the R^2 between in columns (4), (7) and (8) are indeed of 43.2%, 43.8% and 51.8%, respectively. Given that dividend payments and stock buyback are both an expression of shareholders' interests, this first result confirms the shareholders' value orientation of the economy, adding some evidence on its impact on companies additional wealth. Such financial payments to the market indeed may impact on Surplus Wealth passing through the Excess Market Value component (see eq. (1.2)), that in turn depends on stock prices and hence market expectations[26]. Dividend payments and stock repurchase enhance stock prices, increasing market perceived value of a firm and thus increasing Surplus Wealth. Such a positive effect therefore is not be associated with the specific firm's business activity or long-term growth, but with the confidence agents have in the company's ability to generate wealth for its owners. The significance of the acquisition dummy, ACQ_t, suggests that firms can acquire other companies for strategic reasons: the acquisition of existing businesses through increased ownership can increase sSW_t by 0.0282-0.0378 (columns (3), (7)) and may represent a source of market power, given it increases concentration. Another financialization channel that may impact on Surplus Wealth is market funding, $sMKT\ FINANCE_{i,t}$: issuance of new equity might affect market value directly because the share price must be attractive for new investors so, again, we are dealing with value oriented perspectives. Even though shares are typically sold at a price that is lower with respect to that of the outstanding shares, the fact that the new shares will be easily then traded will increase their value. Hence I expected the Issuance of New Stock to significantly and positively affect Surplus Wealth through shareholders' value orientation. On the other hand the prediction of the effect of new bonds' issuance is not as straightforward (many factors, from the project to be funded to ratings delivered by CRAs, are related to bonds' issuance). The result is not clearcut: the positive coefficient (column (5)) turns statistically non-significant as other financialization variables are included (column(7)) and finally negative (column (8)). A similar behaviour is observable for standardized financial profits, $s\pi_t^{fin}$ in column (6): as an expression of successful past financial investment they can fuel further financial investments and increase Surplus Wealth –by eq.(1.2– significantly by 102,96 millions. Once again, however, the significance shades away for longer specifications (columns (7), (8)).[27]. The most important variable appears, however, to be intangibles' expenditure, sI_t^{intan}: a 1 standard deviation increase, indeed, produces an increase of 529,77 millions (column (2)) (or 422,55 millions in column (8)). R&D and advertising expenditure, therefore appear to be the drivers of Surplus Wealth, probably given the competitive advantage that may provide. sI_t^{intan} is followed by $sSALE_t$ and the Tobin's q: firms' growth opportunities still play a role in determining Surplus Wealth[28]. Finally, negative coefficients are recorded for leverage, $sLEV_t$, suggesting that market perceptions on the levels of firms' indebtedness can reduce surplus Wealth. Labor productivity, $Lprod_t$ should

[26] Introducing expectations in the analysis may be interesting, but it is left for future works.

[27] For completeness, column (8) suffers from the high correlation between $sSALES_t$ and sI_t^{intan} (48.3%), and $sSALES_t$ and $sDIV_t$ (43.6%) which might distort results and bias $sSALES_t$ coefficient.

[28] On the Tobin's q, we follow the existing literature on Net Lending[29]

ideally be one of the outcomes of technological progress: innovation should bring about labor productivity as well and, as a result, wages should be aligned to such an increase, thus possibly having a negative impact on Surplus Wealth. Table 3 does not tell this story.

Overall, by looking at results stemming from Table 1.3, we can say that sales, Tobin's q, intangibles' expenditure and shareholders' value orientation (dividends paid and stock buyback) appear to be the drivers of companies' Surplus Wealth, whilst we cannot conclude anything about profits coming from financial investment. Finally, a period subsample analysis is performed and results are shown in Appendix B.2: from 1970 to 1985, (Table 4), no financialization variable but stock buyback -with a substantial lower magnitude- is significant at any level nor it is intangibles' expenditure. The major contribution to Surplus Wealth comes from sales; from 1970 to 1985, intangibles' expenditure starts having a positive impact on Surplus Wealth as well as financial profits; and from 2002 to 2018, there is almost a replication of Table 1.3. Next, Table 1.4 presents results on the same specifications but on two different samples: starting from the entire database and not managing outliers, in order not to loose monopolists (once we drop outliers, indeed, companies reported in Table 1.1, for example, disappear) we take into account firms belonging to the 2^{nd} quartile of the Surplus Wealth distribution (*Q2 sample*) and those belonging to the 95^{th} percentile (*P95 sample*). Before proceeding, it is worth noting an interesting correlation: our measure of Surplus Wealth positively correlates with *Net Lending*[30]: 38.8% in the *representative sample*, and 62.4% and 60.8% in the $Q2$ *sample* and $P95$ *sample* respectively, suggesting that there might exist a relationship -not explored here- between the accumulation of Surplus Wealth among wealthiest companies and their position as net lenders.

Table 1.4: **Fixed-effect regression of Surplus Wealth on sales, leverage, Tobin's q, labor productivity, acquisitions, intangibles' proxy, dividends paid, buybacks, newly issued stocks and bonds and financial profits. All variables but dummies standardized. Period 1970-2018. Q2 sample (left) and P95 sample (right).**

	Q2 sample								P95 sample							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t
$sSALES_t$	0.514***	0.287***	0.514***	0.146*	0.484***	0.485***	0.127*	0.0703**	0.389**	0.256**	0.387**	0.136	0.370**	0.360**	0.116	0.0720
	(0.152)	(0.102)	(0.152)	(0.0777)	(0.148)	(0.155)	(0.0761)	(0.0353)	(0.165)	(0.121)	(0.163)	(0.0937)	(0.160)	(0.167)	(0.0914)	(0.0466)
$sLEV_t$	-0.257	-0.272	-0.258	-0.260	-0.259	-0.260	-0.262	-0.270	0.000152	-0.00476	0.000695	-0.0414	-0.00723	0.00253	-0.0410	-0.0397*
	(0.213)	(0.216)	(0.213)	(0.214)	(0.213)	(0.213)	(0.214)	(0.216)	(0.0330)	(0.0220)	(0.0330)	(0.0293)	(0.0308)	(0.0335)	(0.0291)	(0.0221)
$sTobinQ_t$	0.320	0.338	0.321	0.324	0.322	0.323	0.326	0.336	0.402**	0.422**	0.406**	0.404**	0.403**	0.407**	0.410**	0.423**
	(0.264)	(0.268)	(0.265)	(0.265)	(0.265)	(0.265)	(0.266)	(0.268)	(0.172)	(0.168)	(0.171)	(0.173)	(0.172)	(0.170)	(0.172)	(0.169)
$sLprod_t$	-0.00187	0.00297	-0.00183	0.00180	-0.00134	-0.00286	0.00137	0.00385	0.000458	0.00223	0.000452	0.000269	0.000835	-0.000357	-0.0000823	0.00141
	(0.00592)	(0.00450)	(0.00591)	(0.00294)	(0.00572)	(0.00807)	(0.00406)	(0.00252)	(0.00556)	(0.00701)	(0.00561)	(0.00362)	(0.00572)	(0.00643)	(0.00401)	(0.00423)
sI_t^{intan}		0.491***						0.351***		0.431***						0.344***
		(0.0770)						(0.0913)		(0.0862)						(0.0951)
ACQ_t			0.0211				0.00324	-0.00989			0.110*				0.0617	0.0252
			(0.0180)				(0.0115)	(0.0121)			(0.0580)				(0.0396)	(0.0398)
$sDIV_t$				0.256***			0.255***	0.148***				0.165***			0.165***	0.0894*
				(0.0387)			(0.0365)	(0.0476)				(0.0446)			(0.0421)	(0.0467)
$sBUYBACK_t$				0.315***			0.305***	0.278***				0.311***			0.297***	0.276***
				(0.0695)			(0.0767)	(0.0817)				(0.0764)			(0.0854)	(0.0855)
$sMKT\ FINANCE_t$					0.0840**		0.0292	-0.00923					0.0647		0.0306	-0.00350
					(0.0415)		(0.0223)	(0.0244)					(0.0465)		(0.0256)	(0.0312)
$s\pi_t^{fin}$						0.125**	0.0707	0.0324						0.143***	0.0930*	0.0542
						(0.0504)	(0.0441)	(0.0395)						(0.0543)	(0.0510)	(0.0441)
N. obs.	71054	71054	71054	71054	71054	71054	71054	71054	7135	7135	7135	7135	7135	7135	7135	7135
N. firms	6348	6348	6348	6348	6348	6348	6348	6348	836	836	836	836	836	836	836	836
R^2 *within*	0.191	0.318	0.191	0.355	0.195	0.201	0.359	0.413	0.443	0.533	0.445	0.551	0.446	0.455	0.558	0.609
R^2 *between*	0.252	0.446	0.252	0.478	0.255	0.297	0.496	0.598	0.186	0.235	0.185	0.216	0.190	0.212	0.235	0.256
R^2 *overall*	0.244	0.424	0.245	0.476	0.249	0.268	0.486	0.555	0.384	0.520	0.386	0.541	0.388	0.404	0.553	0.620
Adj. R^2	0.190	0.317	0.190	0.355	0.195	0.201	0.359	0.412	0.439	0.530	0.441	0.548	0.442	0.451	0.554	0.606
Time fixed eff.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* p<.1, ** p<.05, *** p<.01

[30] Net Lending is a measure of excess savings and is calculated as net income plus depreciation and amortization minus capital expenditures. See Villani (2021) for more details.

In both samples leverage looses its significance, whilst growth opportunities appear to have a wide impact on monopoly Surplus Wealth (i.e. in the $P95$ *sample*) together with sales and intangibles' expenditure (the latter variables basically replicate their behaviour as in the *representative sample*). Again, shareholders' value orientation plays a crucial role also in the 2^{nd} quartile and in the 95^{th} percentile of the distribution of Surplus Wealth, where a 1 standard deviation increase in $sDIV_t$ increases sSW_t on average by 0.256 and 0.165, respectively (columns (4) and (12); it was 0.219 in the *representative sample*) – that is an impact of 403.63 and 260.15, respectively, on the unstandardized Surplus Wealth – while if we augment $sBUYBACK_t$'s standard deviation by 1, sSW_t positively moves by 0.315 in the *Q2 sample* (columns (4)) and by 0.313 in the *P95 sample* – that is by 496.66 in the *Q2 sample* and by 493.5 in the *P95 sample* (notice that the magnitude of stock repurchase almost doubles for wealthiest companies with respect to the *representative sample*). The standardized coefficients for dividends payments and stock buyback remains significantly high also when other financialization variables as well as the intangible proxy are added (columns (7), (8), (15), (16)). Lastly, we can observe that also financial profits doubles its coefficient when it comes to high levels of Surplus Wealth: in the *representative sample* the average increase of sSW_t was of 0.0635 whilst we notice a 0.125 increase in the *Q2 sample* (column (6)) and a 0.143 increase in the *P95 sample* (column (14)) after augmenting (standardized) financial profits' of 1 standard deviation. Interestingly, financial profits remains significant once other financialization variables are included in the regression (column (15)) in the *P95 sample*.

To sum up, in all samples the drivers of Surplus Wealth appear to be related to (i) the size of firms ($sSALES_t$); (ii) intangibles' expenditure (sI_t^{intan}) -which has the largest impact in terms of magnitude- and (iii) a selection of financialization variables, $sDIV_t$ and $sBUYBACK_t$ above all, and $s\pi_t^{fin}$, which is however not robust to more complete specifications except for the $P95$ *sample*. Financialization in the form of shareholders' value orientation, hence, seems to play a role in the accumulation of Surplus Wealth, especially for firms with a value of Surplus Wealth above the median and for monopolists (in which case also the effect of financial profits become more robust), suggesting that it contributes to monopoly rents together with intangibles' investment. One last remark: interestingly, in the *representative sample* and in the *Q2 sample* the various models are able to explain the variation among companies' Surplus Wealth more than the variation within them; in the *P95 sample*, the situation is reversed and we find that the model regressions are more able to explain Surplus Wealth variation within the same firm rather than among the different companies.

1.6 Analysis on Investment

1.6.1 Investment: Econometric Specification

In order to test the impact of financial investments, two multiple regression analysis are here conducted: one on tangible capital investment, and the other one on intangible investment, proxied by the sum of R&D and advertising expenditure. The analysis has two main goals:

(i) understanding whether financial assets shape or not companies' tangible capital investment decisions and/or intangible capital investment decisions; (ii) assessing their role for monopolists in particular. A first variable of interest will be past financial profits, $ln\ \pi^{fin}_{t-1}$, which tell us if dividends and interests stemming from financial investment are then re-invested into production. The variable has two limitations: (i) it accounts only for interest and dividend income (we have no information on capital gains) and (ii) the logarithm of π^{fin} has many missing values. We expect financial profits to have an impact on both capital expenditure and intangible expenditure in all samples, because they sistematically increase available internal funds for whatever purpose. The second variable of interest is financial assets, red_τ, which is proxied by redundant assets and the third is short-term financial investment, $s.t.\ i^{fin}_\tau$, which is assumed to entail speculative properties given their highly liquid nature. Both variables are used at time t (to look for a trade-off effect between them and the dependent variable) and in one lag (one can imagine that past financial assets or short-term investment can yield returns or capital gains in period t, so past year financial investments might potentially entail returns and capital gains earned and used in the subsequent year), thus $\tau = \{t-1, t\}$. Since past financial profits, financial investment and short-term financial investment -current and past- are highly correlated with each other, separate regressions will be run. Other control variables are then: past sales, $sales_{t-1}$, which as a primary source of internal funds are expected to serve both tangible capital expenditure and R&D and advertising expenditure[31]; Long-term debt, $debt_{t-1}$, that we expect to be actually unimportant for monopolist firms but more decisive for more competitive firms' investment decisions; financial payments, pay^{fin}_{t-1}, that includes dividends' payments, stock buyback (and thus represents shareholders' value orientation) and cash commitments to financial markets, it can represent a constraint for any type of investment and might decrease expenditure (the *value rather than growth* idea), in line with previous studies on capital investment behaviour (see, for example Orhangazi (2008)); the dummy for acquisitions, ACQ_t, may behave differently in the different samples: we expect acquisitions to have a negative effect on investment for monopolist companies in particular, given the strategic intrinsic nature of these operations (we are assuming that monopolists acquire firms to further reduce competition or not to loose monopoly rents), whilst other firms may acquire other (innovative) firms seeking for monopoly rents (and thus continuing to invest). Summing up, the econometric specifications is the following:

$$i^X_{i,t} = \alpha + \beta_1 i^X_{i,t-1} + \beta_2 sales_{i,t-1} + \beta_3 debt_{i,t-1} + \beta_4 pay^{fin}_{i,t-1} + \beta_5 ACQ_{i,t-1} + +\beta_6 F_{i,\tau} + v_{i,t} \quad (1.4)$$

with $X = \{\kappa; intan\}$, $F_{i,\tau}$ being the set of financial variables of interest ($ln\ \pi^{fin}_{i,t-1}$, $red_{i,\tau}$ and $s.t.\ i^{fin}_{i,\tau}$), with $\tau = \{t-1; t\}$ and $v_{i,t} = u_i + \epsilon_{i,t}$. The first observation about the specification concerns the first lag of the dependent variable used as a predictor: this will cause an endogeneity problem using static models (either fixed or random) exactly because past values of the

[31] Sales can also account for the impact of past operating profits on investment: the two variables have a positive correlation of more than 80% and using operating profits instead of sales does not alter results significantly.

dependent variable are used as regressors, hence they are not independent and are correlated with the error term. Recurring to a dynamic two-step GMM panel model should overcome such identification problem. Given that both subsamples are unbalanced panels, orthogonal deviations seems to be more appropriate[32], for it better deals with missing observations (by using the mean of all future values instead of just the past value to be subtracted to the observation of interest in constructing instruments). The specification model in eq. (1.4) is similar to that of Orhangazi (2008) and it is assumed to be the same for both tangible and intangible capital investment.

1.6.2 Investment: Estimated Results

Table 1.5 presents results concerning capital investment using the *representative sample*. As a preliminary note, both the signs and the significance of some selected regressors are in line with evidence provided by Orhangazi (2008): lagged investment, i^{κ}_{t-1} and past sales, $sales_{t-1}$ are the main drivers of current investments in all specifications, while long-term debt, $debt_{t-1}$ and financial payments, pay^{fin}_{t-1} negatively affect current investment[33]. The same behaviour can be found in Table 1.6, which shows results for the same regressions but in the *Q2 sample* and in the *P95 sample*, with the only interesting exception of financial payments in the latter sample, where we can observe that having to pay for interests, dividends or to re-acquire shares has no effect on capital expenditure for monopolists. Back on Table 1.5, the only contradicting result concerns financial profits, $ln\ \pi^{fin}_{t-1}$, whose 1% increase, instead, appears to increase current investment on average by 3.62%[34]. This positive relationship seems to be confirmed by columns (4) and (5), where past financial investments, red_{t-1}, and lagged short-term financial investment, $s.t.\ i^{fin}_{t-1}$, in particular, seem to contribute to capital investment. Ceteris paribus, hence, having more internal funds -in the form of financial profits or short-term financial investment (which are a component of cash and cash equivalent and therefore easily convertible) in the previous period may be beneficial to investment in tangible capital. However, we cannot exclude a trade-off effect between capital investments and financial investments: columns (2) and (3), indeed, indicate that the decision to increase financial assets by 1% today, decreases capital investment by almost 3% (column (3), and almost 2% if we consider short-term financial investment (column (4))), leaving the overall effect of financial assets on capital expenditure unclear.

If we now observe the outcomes of financial investments on tangible capital investments considering companies with a Surplus Wealth above the median (*Q2 sample*) and those at the very top of the distribution (*P*95 *sample*), the story further changes. In the *Q2 sample* (Table 1.6 left panel) there is no positive effect of past financial investments (column (4), (5))

[32]see Arellano and Bover (1995) and Roodman (2009) for more details.

[33]Orhangazi (2008) includes also $profit$ among the regressors, which in the present datasets, exhibits a serious positive correlation with *sales* and is hence excluded. Substituting *sales* with $profit$ does not alter results significantly (not reported).

[34]Notice that, although it is true that column (1) in Table 1.5 fails many tests -most importantly the AR(2) test- the coefficient of $ln\ \pi^{fin}_{t-1}$ remains positive and highly significant in all subsamples' analysis (Table 1.9 and Table 5) as well as in regression results' on *Q*2 *sample* and *P*95 *sample* (Table 1.6).

while the negative trade-off between capital expenditure and current financial investment is confirmed (columns(2), (3)). Finally, Table 1.6 right panel, tells us that financial investments (current and past, both in the form of redundant assets and in the form of short-term financial investment) are almost irrelevant for capital expenditure decisions for wealthiest companies: the trade-off effect nearly disappears for most rich firms, suggesting that higher financial investment today do not offset physical capital investment as much as in the *representative sample* and *Q2 sample* (the negative sign remains, indeed, and red_t is significant at 10% confidence interval).

A last comment on the acquisition dummy, ACQ_{t-1}: its positive and significant effect observable in the *representative sample*, is reversed once we move to the $Q2$ *sample* and the $P95$ *sample*. In both panels of Table 1.6, indeed, we can say that having acquired a new firm in the previous period decreases current capital expenditure by around 2-3%. Not all specifications, however, corroborate the statistical significance of these coefficients.

Table 1.5: **Dynamic GMM in orthogonal deviations regression of capital investment on past capital investment, sales, long-term debt, financial payments, acquisition dummy, financial profits and current and lagged financial investment (total and short-term). Period 1970-2018. Representative sample.**

	Representative sample				
	(1)	(2)	(3)	(4)	(5)
	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ
i_{t-1}^κ	0.291***	0.273***	0.295***	0.270***	0.394***
	(0.0516)	(0.0551)	(0.0712)	(0.0590)	(0.0767)
$sales_{t-1}$	0.292***	0.262***	0.295***	0.311***	0.286***
	(0.0349)	(0.0294)	(0.0398)	(0.0314)	(0.0413)
$debt_{t-1}$	-0.0299***	-0.0296***	-0.0305***	-0.0246***	-0.0254***
	(0.00548)	(0.00520)	(0.00634)	(0.00537)	(0.00599)
pay_{t-1}^{fin}	-0.0352***	-0.0503***	-0.0476***	-0.0521***	-0.0341***
	(0.00906)	(0.00968)	(0.0113)	(0.01000)	(0.0115)
ACQ_{t-1}	0.0294**	0.0136	0.0311**	0.0243*	0.0296**
	(0.0128)	(0.0122)	(0.0146)	(0.0128)	(0.0149)
$ln\ \pi_{t-1}^{fin}$	0.0362***				
	(0.00653)				
red_t		-0.0299***			
		(0.00525)			
$s.t.\ i_t^{fin}$			-0.0177***		
			(0.00480)		
red_{t-1}				0.0132**	
				(0.00548)	
$s.t.\ i_{t-1}^{fin}$					0.0304***
					(0.00437)
N. obs.	22671	26761	16020	26913	16152
N. firms	1961	2076	1859	2073	1853
$AR(1)\ test: z_1$	-8.21	-7.70	-6.02	-7.32	-6.40
$Prob > z_1$	0.000	0.000	0.000	0.000	0.000
$AR(2)\ test: z_2$	-2.04	-1.55	-0.71	-1.83	-0.05
$Prob > z_2$	0.042	0.120	0.477	0.067	0.962
$Sargan\ test: J_1$	60.54	49.52	43.26	61.52	52.60
$Prob > J_1$	0.050	0.262	0.503	0.041	0.175
$Hansen\ test: J_2$	61.84	44.02	39.58	57.70	51.16
$Prob > J_2$	0.039	0.471	0.661	0.081	0.213
$Time\ fixed\ eff.$	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* p<.1, ** p<.05, *** p<.01

Table 1.6: **Dynamic GMM in orthogonal deviations regression of capital investment on past capital investment, sales, long-term debt, financial payments, acquisition dummy, financial profits and current and lagged financial investment (total and short-term). Period 1970-2018. Q2 sample (left panel) and P95 sample (right panel).**

	Q2 sample					P95 sample				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	i^{κ}_t	i^{κ}_t	i^{κ}_t	i^{κ}_t	i^{κ}_t	i^{κ}_t	i^{κ}_t	i^{κ}_t	i^{κ}_t	i^{κ}_t
i^{κ}_{t-1}	0.276***	0.284***	0.168*	0.351***	0.257***	0.874***	0.721***	0.647***	0.671***	0.579***
	(0.0792)	(0.0741)	(0.0908)	(0.0696)	(0.0887)	(0.112)	(0.138)	(0.143)	(0.144)	(0.151)
$sales_{t-1}$	0.218***	0.212***	0.210***	0.217***	0.185***	0.279***	0.367***	0.389***	0.405***	0.432***
	(0.0307)	(0.0291)	(0.0360)	(0.0285)	(0.0325)	(0.0835)	(0.108)	(0.123)	(0.104)	(0.125)
$debt_{t-1}$	-0.0388***	-0.0381***	-0.0392***	-0.0366***	-0.0367***	-0.0236**	-0.0190**	-0.0248**	-0.0207**	-0.0267**
	(0.00456)	(0.00490)	(0.00620)	(0.00455)	(0.00582)	(0.0104)	(0.00906)	(0.0109)	(0.00948)	(0.0120)
pay^{fin}_{t-1}	-0.0261***	-0.0368***	-0.0442***	-0.0347***	-0.0415***	0.00192	0.00688	-0.00361	0.000941	-0.0166
	(0.00959)	(0.0101)	(0.0118)	(0.00961)	(0.0110)	(0.0143)	(0.0156)	(0.0165)	(0.0158)	(0.0165)
ACQ_{t-1}	0.00218	-0.0238**	-0.0192	-0.0215**	-0.0187	-0.0108	-0.0260*	-0.0314*	-0.0227	-0.0279
	(0.0118)	(0.0106)	(0.0136)	(0.0106)	(0.0135)	(0.0171)	(0.0148)	(0.0176)	(0.0149)	(0.0190)
$ln\ \pi^{fin}_{t-1}$	0.0198***					0.0431***				
	(0.00657)					(0.0159)				
red_t		-0.0351***					-0.0150*			
		(0.00502)					(0.00829)			
$s.t.\ i^{fin}_t$			-0.0228***					-0.00184		
			(0.00525)					(0.00564)		
red_{t-1}				-0.00944*					0.00539	
				(0.00493)					(0.00972)	
$s.t.\ i^{fin}_{t-1}$					0.00493					0.00879*
					(0.00479)					(0.00526)
$N.\ obs.$	20355	26642	16810	26520	16690	2713	3997	2970	3997	2974
$N.\ firms$	2907	3539	2709	3524	2693	327	433	358	435	360
$AR(1)\ test: z_1$	-5.57	-6.23	-4.13	-7.09	-4.80	-5.26	-3.85	-3.09	-3.67	-2.85
$Prob > z_1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.004
$AR(2)\ test: z_2$	-1.28	-1.44	-2.18	-1.16	-1.60	0.67	0.89	0.44	0.82	0.26
$Prob > z_2$	0.199	0.151	0.029	0.245	0.110	0.502	0.376	0.662	0.412	0.796
$Sargan\ test: J_1$	26.95	22.27	18.11	19.42	22.11	37.05	49.84	43.85	54.13	45.47
$Prob > J_1$	0.980	0.997	1.000	1.000	0.998	0.762	0.252	0.478	0.141	0.411
$Hansen\ test: J_2$	58.57	37.37	32.62	33.03	33.85	45.43	43.34	35.85	48.38	41.18
$Prob > J_2$	0.070	0.750	0.897	0.887	0.866	0.412	0.500	0.804	0.301	0.593
$Time\ fixed\ eff.$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* p¡.1, ** p¡.05, *** p¡.01

After having investigated the effect of financial investments (and profits) on capital expenditure, we now try to understand their effects on intangibles' expenditure, proxied by companies' R&D together with disbursements for marketing and branding, i^{intan}. Before commenting on that, however, we make a rapid note on the overall picture stemming from Table 1.7 below. First, the dynamic panel GMM model turned out to be a good model, which was not a foregone conclusion, given that we are assuming that intangibles' investment decisions behave exactly as capital investment decisions[35]. Second, $sales_{t-1}$ and $debt_{t-1}$ affect capital investment and

[35] The goodness of the model falls short in the period subsample anaysis, suggesting that for short ranges of time it is better to use a non-dynamic panel. In every subsample period in Table 6, indeed, we can notice that lagged intangibles investment is not statistically significant in many cases and -as one can notice also from the failure of AR(1) test. This might be due to the large amount of missing values generated when turning variables into logs (R&D and advertising expenditure, indeed, do not count the large amount of observations recorded for capital expenditure). Indeed, if we consider a more extended period for the period subsample analysis (for example if we divide the representative sample into only two subperiods) this issue is less evident and the only specifications that fail the AR(1) test are those that include $s.t.\ i^{fin}$ only, both current and lagged (not reported).

intangibles investment in a similar way, with a lower magnitude in the latter case. Third, financial payments on the contrary seem to be irrelevant for intangible investment decisions, whilst having acquired new firms decreases expenditure in R&D and branding by around 3%. Finally, the positive significant effect of past financial investment disappears if we use them as regressors to explain intangibles investment (columns (4), (5)), while a 1% increase in internal funds in the form of financial profits makes R&D and branding expenditure rise on average by 3.10% (column (1), the coefficient is slightly lower with respect to the one reported for capital expenditure). Again, it seems to exist a trade-off effect with current financial investments (columns (2), (3)) but the statistical significance is low and the magnitude is in the amount of 0.8%. Overall, we can conclude that financialization has more impact on physical capital expenditure rather than on intangibles expenditure, first of all through financial payments (negative and irrelevant, respectively) and then through financial profits (positive in both cases) and financial investment (which do not offer a clear picture of their impact). The interesting insight stemming from the two tables concerns the existence of a possible trade-off between *real* investment (in terms of tangible and intangible capital, something needed in a firm's production activity) and financial investment, which appears however to be stronger for tangible capital expenditure.

We now turn to the $Q2$ *sample* and to the $P95$ *sample*, whose regression outcomes can be found in Table 1.8. Again, for monopolists (right panel) nor financial payments nor acquisitions affect intangibles expenditure. The same holds for current financial investment (columns (7), (8)), suggesting that the investments trade-off effect plays no role and that firms with some market power, on average, can take decisions on how much to invest in R&D and marketing, capital, and marketable securities independently. This result differs from the one characterizing the overall economy and from the one observable for companies belonging to the second quartile of Surplus Wealth distribution where a trade-off effect seems instead to be in place. Lastly, the story goes a little beyond: not only current financial investment are negligible for monopolists' intangible investment, but lagegd financial investment appear to be also positively related to it as well as financial profits. There is hence some room for our initial assumption: the acquisition of financial assets by companies detecting market power may be correlated to strategic motives aimed at maintaining a privileged position in the market by involving R&D and branding/marketing: financial rents appear to have a small role in augmenting monopoly rents coming from intangibles.

Table 1.7: **Dynamic GMM in orthogonal deviations regression of intangible investment on past intangible investment, sales, long-term debt, financial payments, acquisition dummy, financial profits and current and lagged financial investment (total and short-term). Period 1970-2018. Representative sample.**

	Representative sample				
	(1)	(2)	(3)	(4)	(5)
	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}
i_{t-1}^{intan}	0.541***	0.394***	0.315**	0.369***	0.303***
	(0.0977)	(0.0983)	(0.141)	(0.100)	(0.116)
$sales_{t-1}$	0.176***	0.214***	0.192***	0.225***	0.176***
	(0.0340)	(0.0381)	(0.0347)	(0.0379)	(0.0354)
$debt_{t-1}$	-0.0150***	-0.0148***	-0.0193***	-0.0132***	-0.0175***
	(0.00381)	(0.00445)	(0.00549)	(0.00452)	(0.00575)
pay_{t-1}^{fin}	0.0161**	0.00596	0.00434	0.00393	0.00275
	(0.00732)	(0.00803)	(0.0103)	(0.00824)	(0.00935)
ACQ_{t-1}	-0.0352***	-0.0281**	-0.0185	-0.0327**	-0.0311**
	(0.0132)	(0.0131)	(0.0164)	(0.0130)	(0.0152)
$ln\ \pi_{t-1}^{fin}$	0.0310***				
	(0.00515)				
red_t		-0.00817*			
		(0.00447)			
$s.t.\ i_t^{fin}$			-0.00873*		
			(0.00466)		
red_{t-1}				0.00610	
				(0.00452)	
$s.t.\ i_{t-1}^{fin}$					0.00293
					(0.00479)
$N.\ obs.$	17942	20295	12419	20419	12520
$N.\ firms$	1725	1879	1610	1872	1604
$AR(1)\ test : z_1$	-5.29	-4.48	-2.77	-4.25	-3.13
$Prob > z_1$	0.000	0.000	0.006	0.000	0.002
$AR(2)\ test : z_2$	1.77	1.32	0.57	1.15	0.52
$Prob > z_2$	0.077	0.185	0.571	0.251	0.601
$Sargan\ test : J_1$	25.79	53.81	54.46	49.22	51.00
$Prob > J_1$	0.987	0.148	0.134	0.272	0.218
$Hansen\ test : J_2$	35.36	61.73	55.50	51.76	52.43
$Prob > J_2$	0.820	0.040	0.115	0.197	0.179
$Time\ fixed\ eff.$	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* p<.1, ** p<.05, *** p<.01

Table 1.8: **Dynamic GMM in orthogonal deviations regression of intangible investment on past intangible investment, sales, long-term debt, financial payments, acquisition dummy, financial profits and current and lagged financial investment (total and short-term). Period 1970-2018. Q2 sample (left panel) and P95 sample (right panel).**

	Q2 sample					P95 sample				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}
i_{t-1}^{intan}	0.355**	0.420***	0.465***	0.411***	0.404***	0.351**	0.447**	0.414***	0.451***	0.475***
	(0.147)	(0.100)	(0.150)	(0.106)	(0.147)	(0.176)	(0.187)	(0.150)	(0.167)	(0.158)
$sales_{t-1}$	0.166***	0.181***	0.159***	0.183***	0.158***	0.446***	0.434***	0.440***	0.432***	0.417***
	(0.0278)	(0.0252)	(0.0262)	(0.0260)	(0.0250)	(0.0972)	(0.0926)	(0.0939)	(0.0864)	(0.0909)
$debt_{t-1}$	-0.0244***	-0.0218***	-0.0232***	-0.0229***	-0.0228***	-0.00751	-0.0153**	-0.0143*	-0.0156**	-0.0164*
	(0.00460)	(0.00331)	(0.00375)	(0.00346)	(0.00404)	(0.00907)	(0.00727)	(0.00806)	(0.00736)	(0.00898)
pay_{t-1}^{fin}	0.0196***	0.0204***	0.0237***	0.0186***	0.0194***	-0.0199	-0.00130	-0.00205	0.00257	-0.00162
	(0.00647)	(0.00545)	(0.00726)	(0.00531)	(0.00673)	(0.0148)	(0.0143)	(0.0151)	(0.0144)	(0.0145)
ACQ_{t-1}	-0.0151	-0.0383***	-0.0380***	-0.0391***	-0.0365***	0.0222	-0.00930	-0.0156	-0.00602	-0.0170
	(0.0155)	(0.0102)	(0.0133)	(0.0103)	(0.0137)	(0.0248)	(0.0236)	(0.0268)	(0.0208)	(0.0271)
$ln\ \pi_{t-1}^{fin}$	0.0319***					0.0295**				
	(0.00600)					(0.0147)				
red_t		-0.0150***					-0.00504			
		(0.00369)					(0.00804)			
$s.t.\ i_t^{fin}$			-0.00578**					0.00492		
			(0.00294)					(0.00610)		
red_{t-1}				-0.00526					0.0148*	
				(0.00395)					(0.00858)	
$s.t.\ i_{t-1}^{fin}$					0.00266					0.0144**
					(0.00338)					(0.00603)
$N.\ obs.$	15248	19508	12953	19441	12864	2477	3558	2686	3550	2685
$N.\ firms$	2196	2664	2097	2656	2085	271	351	300	353	302
$AR(1)\ test: z_1$	-3.29	-4.87	-3.54	-4.51	-3.26	-2.49	-2.93	-3.01	-3.09	-3.07
$Prob > z_1$	0.001	0.000	0.000	0.000	0.001	0.013	0.003	0.003	0.002	0.002
$AR(2)\ test: z_2$	-0.14	0.63	0.51	0.36	0.37	0.70	1.59	1.25	1.51	1.51
$Prob > z_2$	0.887	0.526	0.602	0.716	0.715	0.483	0.112	0.210	0.132	0.131
$Sargan\ test: J_1$	29.91	19.95	19.54	26.41	18.54	51.73	55.45	55.51	57.43	58.60
$Prob > J_1$	0.958	0.999	0.999	0.984	1.000	0.197	0.115	0.114	0.084	0.069
$Hansen\ test: J_2$	46.75	34.04	26.90	38.59	25.81	48.08	44.71	39.44	45.42	42.07
$Prob > J_2$	0.360	0.860	0.980	0.702	0.987	0.311	0.442	0.646	0.413	0.555
$Time\ fixed\ eff.$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* p<.1, ** p<.05, *** p<.01

1.6.3 Investment: IT Subsamples' Analysis

Since Figure1.2 illustrates a different composition in terms of IT firms in the different samples, we take advantage of the possibility of running subsamples' analysis in order to push the discussion one step ahead: we want to figure out whether the investment behaviour observed in the previous tables is the same for firms operating in the IT sector and those operating in the non-IT sector or not, with particular attention paid to monopolists ($P95$ *sample*). We then divide the samples according to whether a company has a $\chi = 0$ (non-IT sector) or a $\chi = \{0.5, 1\}$ (IT sector, both partially or fully). Table 1.9 shows results for the IT subsamples' analysis (*representative sample*): the right panel suggests that although past financial profits have a higher magnitude on capital expenditure for IT firms (column (6) vs. column (1)), lagged investment themselves seem to play no role (column (9), (10)); whilst they do if we turn to non-IT firms (column (4), (5)), where all regressors' behavior basically replicate results in Table 1.5 (trade-off effect between capital investment and financial investment included). Table

1.11, instead, shows results for the *P95 sample*: financial profits and financial investment (both at time t and at time t-1; both as assets and as short-term investment) seem to play absolutely no role for IT firms[36].

Concerning intangible investment for the *representative sample*, instead, Table 1.10 highlights that financial profits have greater effects in the IT sector (column (6) vs. column (1)[37]) and that acquisitions in the previous period significantly decrease R&D and marketing expenses considerably. Concerning financial assets and short-term financial investment, there is only a timid significance of the trade-off effect for the former variable in both subsamples[38]. Lastly, in the *P95 sample* the acquisition dummy looses of importance and our variables of interest become significant only for the IT subsample, where financial profits, but mostly, past financial assets and past short-term financial investment are highly significant and with a positive influence on intangible expenditure (Table1.12, right panel). One can interpret this result as the fact that higher returns (also in terms of capital gains) provided from holding/selling financial assets also increases expenditure in order to maintain monopoly rents stemming from IT innovations and branding. Moreover, there is no room for the trade-off effect (current short-term financial investment are even positive and significant (Table1.12), column (8)), whilst the negative sign persists in the Non-IT subsample (but there is no significance). This important result seems to confirm our assumption of a liaison between market power (remember that corporations in the *P*95 *sample* are those belonging to the 95*th* percentile of Surplus Wealth distribution), IT and financialization in the form of financial investment.

[36]In the *Q*2 *sample* IT firms are not affected by financial profits and lagged financial investment but there exists a trade-off with current financial investment and capital expenditure, non-reported table

[37]the same holds for the *Q2 sample*, table not reported

[38]in the *Q2 sample* the trade-off effect holds for both types of financial investment at time t while they are insignificant in t-1, not reported

Table 1.9: **Dynamic GMM in orthogonal deviations regression of capital investment on past capital investment, sales, long-term debt, financial payments, acquisition dummy, financial profits and current and lagged financial investment (total and short-term). Period 1970-2018. Representative sample: Non-IT subsample (left panel) and IT subsample (right panel).**

	Representative sample									
	NON-IT SUBSAMPLE					IT SUBSAMPLE				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ
i_{t-1}^κ	0.315***	0.316***	0.344***	0.302***	0.424***	0.345***	0.229**	0.164	0.222*	0.191
	(0.0545)	(0.0546)	(0.0700)	(0.0587)	(0.0732)	(0.0995)	(0.114)	(0.129)	(0.133)	(0.142)
$sales_{t-1}$	0.333***	0.306***	0.350***	0.362***	0.338***	0.261***	0.198***	0.260***	0.230***	0.247***
	(0.0413)	(0.0342)	(0.0434)	(0.0358)	(0.0475)	(0.0596)	(0.0506)	(0.0669)	(0.0543)	(0.0621)
$debt_{t-1}$	-0.0347***	-0.0357***	-0.0378***	-0.0331***	-0.0272***	-0.0206**	-0.0224***	-0.0213**	-0.0142*	-0.0171*
	(0.00705)	(0.00683)	(0.00904)	(0.00703)	(0.00883)	(0.00842)	(0.00756)	(0.00926)	(0.00805)	(0.00911)
pay_{t-1}^{fin}	-0.0384***	-0.0471***	-0.0485***	-0.0479***	-0.0305**	-0.0261*	-0.0458***	-0.0624***	-0.0524***	-0.0548***
	(0.0110)	(0.0108)	(0.0132)	(0.0110)	(0.0126)	(0.0148)	(0.0171)	(0.0186)	(0.0198)	(0.0202)
ACQ_{t-1}	0.0425***	0.0136	0.0351**	0.0279*	0.0370**	-0.00885	-0.00118	0.0192	0.00156	0.0118
	(0.0146)	(0.0136)	(0.0175)	(0.0144)	(0.0181)	(0.0256)	(0.0247)	(0.0252)	(0.0263)	(0.0246)
$ln\ \pi_{t-1}^{fin}$	0.0351***					0.0474***				
	(0.00739)					(0.0124)				
red_t		-0.0305***					-0.0279***			
		(0.00600)					(0.00948)			
$s.t.\ i_t^{fin}$			-0.0187***					-0.0222**		
			(0.00552)					(0.00895)		
red_{t-1}				0.0162***					0.00511	
				(0.00618)					(0.0101)	
i_{t-1}^{fin}					0.0370***					0.0109
					(0.00488)					(0.00900)
$N.\ obs.$	16556	19842	11356	19976	11471	6115	6919	4664	6937	4681
$N.firms$	1375	1437	1279	1434	1283	586	639	580	639	570
$AR(1)\ test: z_1$	-7.74	-7.90	-6.37	-7.40	-6.70	-4.82	-3.69	-2.92	-3.20	-2.75
$Prob > z_1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.001	0.006
$AR(2)\ test: z_2$	-1.96	-1.14	-0.13	-1.67	0.39	-0.44	-0.79	-1.02	-0.77	-0.99
$Prob > z_2$	0.050	0.254	0.898	0.095	0.699	0.663	0.428	0.307	0.443	0.322
$Sargan\ test: J_1$	57.23	36.53	57.88	45.77	66.59	36.56	46.50	25.84	50.00	34.46
$Prob > J_1$	0.087	0.780	0.078	0.399	0.016	0.779	0.370	0.987	0.247	0.848
$Hansen\ test: J_2$	62.61	33.79	45.08	45.52	48.57	36.94	39.00	32.66	45.05	36.98
$Prob > J_2$	0.034	0.867	0.427	0.409	0.294	0.766	0.685	0.896	0.428	0.764
$Time\ fixed\ effect$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* p<.1, ** p<.05, *** p<.01

Table 1.10: **Dynamic GMM in orthogonal deviations regression of intangible investment on past intangible investment, sales, long-term debt, financial payments, acquisition dummy, financial profits and current and lagged financial investment (total and short-term). Period 1970-2018. Representative sample: Non-IT subsample (left panel) and IT subsample (right panel).**

	Representative sample									
	NON-IT SUBSAMPLE					**IT SUBSAMPLE**				
	(1) i_t^{intan}	(2) i_t^{intan}	(3) i_t^{intan}	(4) i_t^{intan}	(5) i_t^{intan}	(6) i_t^{intan}	(7) i_t^{intan}	(8) i_t^{intan}	(9) i_t^{intan}	(10) i_t^{intan}
i_{t-1}^{intan}	0.567***	0.386***	0.547***	0.397***	0.490***	0.366***	0.495***	0.350**	0.492***	0.358**
	(0.122)	(0.126)	(0.140)	(0.109)	(0.135)	(0.124)	(0.131)	(0.153)	(0.121)	(0.157)
$sales_{t-1}$	0.180***	0.256***	0.201***	0.283***	0.179***	0.189***	0.163***	0.148***	0.168***	0.137***
	(0.0608)	(0.0682)	(0.0563)	(0.0700)	(0.0661)	(0.0407)	(0.0363)	(0.0376)	(0.0338)	(0.0367)
$debt_{t-1}$	-0.00945*	-0.0104	-0.0106*	-0.0106	-0.0117*	-0.0220***	-0.0160***	-0.0208***	-0.0133**	-0.0154**
	(0.00520)	(0.00675)	(0.00633)	(0.00685)	(0.00670)	(0.00666)	(0.00595)	(0.00622)	(0.00594)	(0.00721)
pay_{t-1}^{fin}	0.0223**	0.00508	0.0142	0.00652	0.0125	0.00841	0.0150	0.0163	0.0146	0.0137
	(0.00929)	(0.0120)	(0.0134)	(0.0110)	(0.0132)	(0.0109)	(0.0101)	(0.0104)	(0.0103)	(0.0116)
Acq_{t-1}	-0.0225	-0.0147	-0.0180	-0.0199	-0.0303*	-0.0680***	-0.0716***	-0.0578**	-0.0810***	-0.0548**
	(0.0166)	(0.0173)	(0.0178)	(0.0156)	(0.0171)	(0.0182)	(0.0191)	(0.0224)	(0.0177)	(0.0223)
$ln\ \pi_{t-1}^{fin}$	0.0272***					0.0411***				
	(0.00588)					(0.0120)				
red_t		-0.00928*					-0.0120*			
		(0.00544)					(0.00724)			
$s.t.\ i_t^{fin}$			-0.00606					-0.00274		
			(0.00508)					(0.00688)		
red_{t-1}				0.00661					0.00905	
				(0.00526)					(0.00764)	
$s.t.\ i_{t-1}^{fin}$					0.00291					0.00261
					(0.00487)					(0.00806)
$N.\ obs.$	12628	14485	8410	14595	8491	5314	5810	4009	5824	4029
$N.\ firms$	1181	1287	1080	1284	1076	544	592	530	588	528
$AR(1)\ test: z_1$	-4.29	-3.37	-3.44	-3.75	-3.27	-3.35	-4.05	-2.72	-4.21	-2.57
$Prob > z_1$	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.007	0.000	0.010
$AR(2)\ test: z_2$	1.79	1.03	1.53	1.04	1.42	0.24	1.13	-0.12	1.14	-0.39
$Prob > z_2$	0.073	0.304	0.127	0.299	0.154	0.809	0.258	0.904	0.253	0.695
$Sargan\ test: J_1$	29.24	47.90	68.07	44.07	65.73	20.23	64.42	47.42	52.12	53.22
$Prob > J_1$	0.957	0.318	0.011	0.469	0.019	0.999	0.024	0.335	0.187	0.161
$Hansen\ test: J_2$	35.81	48.89	45.68	40.76	54.92	37.55	60.38	48.52	53.43	50.02
$Prob > J_2$	0.806	0.283	0.402	0.611	0.125	0.743	0.051	0.296	0.156	0.247
$Time\ fixed\ eff.$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* p<.1, ** p<.05, *** p<.01

Table 1.11: **Dynamic GMM in orthogonal deviations regression of capital investment on past capital investment, sales, long-term debt, financial payments, acquisition dummy, financial profits and current and lagged financial investment (total and short-term). Period 1970-2018. P95 sample: Non-IT subsample (left panel) and IT subsample (right panel).**

	P95 sample									
	NON-IT SUBSAMPLE					IT SUBSAMPLE				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	i^{κ}_t	i^{κ}_t	i^{κ}_t	i^{κ}_t	i^{κ}_t	i^{κ}_t	i^{κ}_t	i^{κ}_t	i^{κ}_t	i^{κ}_t
i^{κ}_{t-1}	0.733***	0.658***	0.758***	0.644***	0.675***	0.680***	0.558***	0.575***	0.565***	0.562***
	(0.124)	(0.147)	(0.145)	(0.137)	(0.141)	(0.132)	(0.125)	(0.130)	(0.143)	(0.140)
$sales_{t-1}$	0.319***	0.387***	0.315**	0.400***	0.321**	0.314**	0.448***	0.480***	0.427***	0.488***
	(0.115)	(0.123)	(0.128)	(0.113)	(0.128)	(0.124)	(0.111)	(0.110)	(0.113)	(0.109)
$debt_{t-1}$	-0.0340***	-0.0316***	-0.0325***	-0.0347***	-0.0405***	-0.0332*	-0.0152	-0.0199*	-0.0170	-0.0170
	(0.0109)	(0.00897)	(0.0121)	(0.00970)	(0.0115)	(0.0187)	(0.0118)	(0.0108)	(0.0121)	(0.0122)
pay^{fin}_{t-1}	0.00473	0.0292	0.0376	0.0215	0.0190	-0.0169	-0.00616	-0.0207	-0.00372	-0.0261*
	(0.0167)	(0.0207)	(0.0232)	(0.0199)	(0.0208)	(0.0280)	(0.0162)	(0.0162)	(0.0166)	(0.0155)
ACQ_{t-1}	0.0241	-0.00611	-0.0210	0.00589	-0.0101	-0.0260	-0.0436*	-0.0314	-0.0535**	-0.0106
	(0.0213)	(0.0173)	(0.0203)	(0.0176)	(0.0227)	(0.0361)	(0.0263)	(0.0296)	(0.0264)	(0.0299)
$ln\pi^{fin}_{t-1}$	0.0432***					0.0173				
	(0.0151)					(0.0456)				
red_t		-0.0226**					-0.00606			
		(0.00982)					(0.0116)			
$s.t.\ i^{fin}_t$			-0.00274					0.00385		
			(0.00856)					(0.00774)		
red_{t-1}				0.00218					0.0111	
				(0.0104)					(0.0120)	
$s.t.\ i^{fin}_{t-1}$					0.0143*					0.0108
					(0.00829)					(0.00679)
$N.\ obs.$	1659	2379	1592	2383	1603	1054	1618	1378	1615	1371
$N.\ firms$	204	275	215	277	216	123	158	143	158	144
$AR(1)\ test: z_1$	-4.01	-2.81	-2.26	-2.79	-2.24	-3.61	-3.44	-3.28	-3.21	-3.01
$Prob > z_1$	0.000	0.005	0.024	0.005	0.025	0.000	0.001	0.001	0.001	0.003
$AR(2)\ test: z_2$	0.15	1.10	0.82	1.06	0.72	0.77	-0.19	-0.17	-0.06	-0.12
$Prob > z_2$	0.877	0.272	0.413	0.289	0.469	0.442	0.847	0.867	0.953	0.907
$Sargan\ test: J_1$	35.17	30.81	28.51	32.82	25.36	57.23	59.29	43.97	60.07	49.46
$Prob > J_1$	0.826	0.934	0.966	0.892	0.989	0.087	0.062	0.473	0.054	0.264
$Hansen\ test: J_2$	40.14	35.64	39.98	40.38	47.98	47.37	32.91	31.77	35.53	35.26
$Prob > J_2$	0.638	0.811	0.645	0.627	0.314	0.337	0.890	0.916	0.815	0.824
$Time\ fixed\ eff.$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* p<.1, ** p<.05, *** p<.01

Table 1.12: **Dynamic GMM in orthogonal deviations regression of capital investment on past capital investment, sales, long-term debt, financial payments, acquisition dummy, financial profits and current and lagged financial investment (total and short-term). Period 1970-2018. P95 sample: Non-IT subsample (left panel) and IT subsample (right panel).**

	P95 sample									
	NON-IT SUBSAMPLE					IT SUBSAMPLE				
	(1) i_t^{intan}	(2) i_t^{intan}	(3) i_t^{intan}	(4) i_t^{intan}	(5) i_t^{intan}	(6) i_t^{intan}	(7) i_t^{intan}	(8) i_t^{intan}	(9) i_t^{intan}	(10) i_t^{intan}
i_{t-1}^{intan}	0.524***	0.645***	0.611***	0.646***	0.666***	0.534**	0.485***	0.344**	0.358***	0.370*
	(0.126)	(0.107)	(0.0781)	(0.0986)	(0.0804)	(0.209)	(0.129)	(0.164)	(0.136)	(0.208)
$sales_{t-1}$	0.333***	0.320***	0.303***	0.330***	0.249***	0.383***	0.459***	0.559***	0.523***	0.587***
	(0.103)	(0.0688)	(0.0782)	(0.0635)	(0.0624)	(0.104)	(0.0746)	(0.0968)	(0.0846)	(0.111)
$debt_{t-1}$	0.0131	-0.0111	-0.00923	-0.00753	-0.0189*	-0.0195**	-0.0255***	-0.0249***	-0.0251***	-0.0238**
	(0.0121)	(0.00962)	(0.00992)	(0.00943)	(0.0114)	(0.00898)	(0.00787)	(0.00950)	(0.00835)	(0.00991)
pay_{t-1}^{fin}	0.0199	0.0421*	0.0261	0.0373*	0.0347	-0.0189	-0.0126	-0.0143	-0.0140	-0.0113
	(0.0208)	(0.0217)	(0.0209)	(0.0213)	(0.0211)	(0.0185)	(0.0153)	(0.0190)	(0.0168)	(0.0224)
ACQ_{t-1}	0.00220	-0.0108	-0.0441*	-0.0103	-0.0289	0.00632	-0.0251	-0.00422	-0.0162	-0.00528
	(0.0310)	(0.0211)	(0.0236)	(0.0198)	(0.0256)	(0.0309)	(0.0270)	(0.0318)	(0.0251)	(0.0348)
$ln\pi_{t-1}^{fin}$	0.0213					0.0484*				
	(0.0171)					(0.0262)				
red_t		-0.0143					0.00813			
		(0.00950)					(0.0137)			
$s.t.\ i_t^{fin}$			-0.0100					0.0234**		
			(0.00826)					(0.0104)		
red_{t-1}				0.00294					0.0379***	
				(0.00986)					(0.0139)	
$s.t.\ i_{t-1}^{fin}$					0.00788					0.0339***
					(0.00743)					(0.0116)
$N.\ obs.$	1451	2009	1355	2004	1364	1026	1549	1331	1546	1321
$N.\ firms$	157	204	166	206	167	114	147	134	147	135
$AR(1)\ test: z_1$	-2.35	-3.07	-2.67	-3.07	-2.73	-2.78	-3.69	-2.71	-3.23	-2.48
$Prob > z_1$	0.019	0.002	0.008	0.002	0.006	0.005	0.000	0.007	0.001	0.013
$AR(2)\ test: z_2$	0.90	1.81	1.35	1.64	1.48	0.73	1.38	0.56	1.03	0.82
$Prob > z_2$	0.369	0.070	0.178	0.100	0.139	0.466	0.169	0.577	0.301	0.412
$Sargan\ test: J_1$	48.77	58.25	54.34	60.74	58.25	33.70	26.19	26.20	23.23	26.12
$Prob > J_1$	0.287	0.074	0.137	0.048	0.074	0.870	0.985	0.985	0.996	0.985
$Hansen\ test: J_2$	48.14	44.66	39.77	45.57	45.21	45.53	39.12	41.21	41.32	43.21
$Prob > J_2$	0.309	0.444	0.653	0.406	0.421	0.408	0.680	0.592	0.587	0.505
$Time\ fixed\ eff.$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* p<.1, ** p<.05, *** p<.01

1.7 Conclusions

The empirical analysis presented in this chapter might entail different contributions, a first one supporting the value oriented view of the overall economy and for monopolists, being their Surplus Wealth very sensitive to changes in intangible investment (value coming from information technology and related innovations/exploitation) and dividend payments and stock buyback in particular and in financial profits in the latter sample (value coming from financialization); a second one providing some insights on the role of financial investment for corporations, in particular for capital investment decisions (both tangible and intangible) and a last one that shed some more light on financialization and market power. Results indeed suggest that firms detecting huge levels of Surplus Wealth (called monopolists) (i) appear to employ past financial investment/financial profits to increase R&D and advertising expenditure rather than physical capital investment, whilst the opposite holds for the economy as a whole and (ii) do not face any trade-off effect between current financial investment and current capital investment (either tangible or intangible). Further, monopolists operating in the IT sector display significant positive coefficients for financial profits, current and past financial assets and short-term financial investment only concerning intangible investment decisions, while the same variables are insignificant for physical capital investment decisions (it is quite the opposite in the case of monopolists not operating in the IT sector). According to this analysis, therefore, we can not exclude a linkage between the accumulation of financial assets and market power, given IT monopolists' tendency to increase R&D and advertising rather than plant, equipment and machineries. The conclusion is not however that financial investment are beneficial to R&D (intended as a motor of innovation and growth for the overall economy), but rather that they might be beneficial to the maintainance of the monopolists' moat (monopoly rents provided by intangibles), especially in the IT sector and thus detrimental to competition (in this context, the Surplus Wealth measure might represent an alternative measure to calculate and study market power). Moreover, for the economy as a whole, although financial profits seem to positively affect both tangible and intangible capital expenditure, the emergence of a trade-off between financial assets and capital investment nullifies such positive effect and, further, raises some more concerns about the financialization of the economy. The trade-off effect entails two big concerns that we should address: first, it supports the value oriented view of the economy at the expense of growth (the positive effect of financial profits and past financial assets/investment are indeed mattified, requiring further investigation) and second, the component of risk entering corporations' internal funds through financial investment should not be ignored.

Chapter 2

When Firms Buy Corporate Bonds: an Agent-Based Approach to Credit Within Firms in a Schumpeterian Framework

2.1 Introduction

While the first chapter provided some insights of a possible correlation between R&D and the rise of financial assets, specifically in the form of corporate bonds, the second chapter tries to address such correlation in a more theoretical framework. The idea behind this chapter is to introduce these two features together into a macroeconomic agent-based model, which allows to manipulate behavioural rules to deal with uncertain frameworks. One purpose is to introduce some differentiation in capital and this is done by adding intangible capital in a CATS model[1] by means of a capital aggregator. To further circumscribe the analysis, two strong and simplifying assumptions are made: first, intangible capital is confined to what concerns the IT and digitalization, such as softwares, platforms, clouds, artificial intelligence and/or databases involving Big Data (patents in terms of asset value, goodwill or this sort of intangibles are here ignored), which allows to attach some intrinsic advertising properties to capital; second and consequently, intangible capital is strongly affected by innovations. The innovation process is assumed to be endogenous to the system, taking inspiration from Schumpeterian theories, which are at the roots of the behavioural assumptions on R&D shaping capital producers. Since the model introduces the accumulation of financial assets by means of bonds' purchasing, we want to assess whether their interaction may impact on macroeconomic variables such as GDP fluctuations and employment in a context of endogenous growth. The great majority of studies concerning financialization shows evidence about the negative effect it has on the real economy:

[1] In macroeconomic ABMs, the CATS model is theorized in Assenza, Delli Gatti, and Grazzini (2015), while the K+S model (which will be cited frequently) refers to Dosi, Fagiolo, and Roventini (2010). See Dawid and Delli Gatti (2018) for a complete overview of macro ABMs.

this work mainly follows this tradition, although the effects of bonds' purchase is not always detrimental to growth. Overall, financial assets do not contribute to enhance technological progress in this specific setting: this is due to credit rationing and the emergence of a possible trade-off mechanism. Surprisingly, financial fragility is affected only in the best scenario, when the finance-growth nexus succeeds in fostering growth.

The chapter is organized as follows: section 2.2 provides a brief overview of past and recent literature, with particular attention to models used as reference in this work; section 2.3 extensively illustrates the theoretical model that has been constructed; section 2.4 is dedicated to simulations and presentation of results. A brief discussion with concluding remarks complete the chapter.

2.2 Related Literature

AB models have experienced a flourishing period, given their ability to shape behavioural assumptions and solve the emerging complex related interactions with no closed form solutions. A first summarizing review on macro ABMs, Dawid and Delli Gatti (2018), identifies eight different families of models and carry a brief but comprehensive illustration of their main characteristics that helps mapping the main ideas behind those models. Among them, two families of models has been taken as main reference to develop the current chapter. The first one is the CATS model, in particular, Assenza, Delli Gatti, and Grazzini (2015) and Delli Gatti and Grazzini (2020); while the second one is the K+S model, Dosi, Fagiolo, and Roventini (2010). The former work's big contribution is related to its ability to replicate autocorrelation patterns of macroeconomic variables endogenously through the interaction of agents' adaptive behaviour in dealing with uncertainty (which transfers memory from individual rules to time series macro variables), without recurring to an exogenous AR(1) shock, typically used in standard macroeconomic models. The introduction of capital good firms, other than further enhancing this result, can also generate – together with the inclusion of a credit market – GDP fluctuations and crisis. It is, therefore, stressed the importance of the upstream-downstream mechanism between firms producing capital good and firms purchasing it to produce consumption good. This relation, together with the interaction with the financial sector and agents' bounded rationality, has an impact on business cycles and on the emergence of crises. In the CATS model, indeed, financial decisions are clearly linked to investment decisions regarding firms' capital structure, with capital assumed to be fixed in the short run. Delli Gatti and Grazzini (2020) extend the model by introducing a public sector that collects taxes and provides transfers to unemployed and by proposing a Bayesian estimation technique for the calibration of parameters, to make an attempt in providing an answer to criticism on the hyper-parametrization of agent-based models. The issue of initial calibration has been addressed also by Caiani, Godin, Caverzasi, Gallegati, Kinsella, and Stiglitz (2016), paying particular attention to stock-flow consistency. They propose a six-step procedure to initialize and homogeneize all agents in a steady state, in order to get rid of arbitrariness and overcome the problem of biased results due to asymmetric initial conditions. Heterogeneity then arises because of their stochastic behaviour and their interactions make the dynamics of the model emerging. The model is able to replicate macroeconomic stylized facts (as the pro-cyclicality of investment, consumption and inflation and the counter-cyclicality of unemployment and mark-ups). One of the main results highlights how long-run dynamics can be affected by instability because of disproportionate investment and credit. The model, however is converging to a *quasi SS*, and the introduction of growth is addressed in a subsequent and more recent paper, Caiani, Russo, and Gallegati (2019). Preliminary macro AB models regarding fluctuations and growth due to innovation are introduced in Cincotti, Raberto, and Teglio (2010, 2012), Dawid, Gemkow, Harting, Van der Hoog, and Neugart (2012) and Dosi, Fagiolo, and Roventini (2010). In particular, in the K+S model, Dosi, Fagiolo, and Roventini (2010) shapes technological progress in a Schumpeterian framework, endogenously generating supply shocks and studying the related effects on the macroeconomy. The innovation process is built on R&D expenditure and propagates from upstream firms to downstream firms through the entailed productivity of capital in investment decisions. The most interesting feature of this work lies exactly on the innovation process design, which is eventually able to replicate the main macro and micro stylized facts. The Schumpeterian environment is well stated, especially for what concerns the entry/exit dynamics, while low effort appears to have been done for modeling competition among incumbents. Their most important result confirm that fiscal policies are necessary in order to sustain the economy and avoid "bad trajectories" caused by the Schumpeterian mechanism, which in their model is unable to maintain a self-sustained growth close to full-employment alone. The K+S model links R&D expenditure of incumbents to past sales in an exogenous manner and leaves the Schumpeterian mechanism working only through the entry dynamics while effects on technological frontier due to competition among incumbents is left apart. The latter issue has been addressed specifically by Aghion, Bloom, Blundell, Griffith, and Howitt (2005) through a Schumpeterian (equilibrium) growth model which led to the U-shaped relationship between product market competition and innovation. In what follows, we try to address the Schumpeterian mechanism in a very trivial way, which, however, replicates the basic ideas of Schumpeter et al. (1939) about innovation processes. A very strong assumption concerns innovation and investment which are assumed to involve only intangibles, whose importance have become increasingly relevant over the last decades (whilst we know that tangible capital accumulation has progressively decreased). As will be explained throughout the chapter, intangible capital can entail specific IT properties, especially in the case of artificial intelligence (such as data collecting and algorithms for advertising), which allow us to shape search and matching accordingly – something that cannot be done with tangible capital. In a very recent paper by Bertani, Ponta, Raberto, Teglio, and Cincotti (2021) we can find the same intuitions regarding intangibles: they consider "software or any other digitalised knowledge-based assets, e.g., algorithms, advanced routines, instructions" as a "new class of productive capital"[2] and modeled it modeled in an agent-based framework. However, they follow the EURACE tradition and firms produce according to a Cobb-Douglas

[2]Bertani, Ponta, Raberto, Teglio, and Cincotti (2021) page 352.

production function where the factors of productions are labor and tangible capital (and where the latter is assumed to be an endowment – we will make the same assumption). Eventually, intangible assets are not conceived as part of capital but enter the production function through the total factor productivity. Our approach, instead, consists in an attempt of constructing an firm-level aggregate measure for capital including both physical and intangible capital. About information technology, a paper by Kurz (2017) highlights how monopoly rents can arise in IT driven businesses, shedding some light on capital employed by the firm and wealth produced for its owners. Intangibles are here not assumed to directly create wealth for shareholders but nevertheless they are supposed to be linked with market power exactly through the data collecting mechanism. Apart from monopoly rents stemming from IT, modern-days companies can also enjoy other types of rents that can have an impact on their wealth: rents coming from the financial sector. An interesting empirical study of Duchin, Gilbert, Harford, and Hrdlicka (2017) confirms that a substantial percentage of corporations' liquidity is composed of financial risky assets, among which the 23,6% represent corporate bonds. Although the phenomenon is still minor, it is worth of attention. Also a recent OECD study, Çelik, Demirtas, and Isaksson (2020), has highlighted some important features concerning corporate bonds' trends. First of all, the corporate debt market is increasing in size, globally reaching the \$13,5 trillion record in 2019. Second, in the last years the bond market has been dominated by low quality, BBB rated newly issued bonds, while a growing portion ranging from 20% in 2010 to 25% in 2019 is occupied by junk bonds (non-investment grade bonds)[3]; moreover, issuers have increased their leverage ratios over the last ten years. Third, since 2009 non-financial companies have became important bondholders, although the financial sector still remains the major holder[4]. "Between 2009 and 2018, the combined value of corporate bond holdings by 25 large non-financial US companies tripled from USD 119 billion to USD 356 billion. The company with the largest portfolio alone held USD 124 billion in corporate debt securities. This equals the combined holdings of the world's 6 largest corporate bond ETFs (exchange traded funds)"[5]. In 2018, indeed, US corporate bonds were held by insurance and pension funds for 49%, investment funds for 28% and by non-financial corporations for 13%[6]. The increase in corporate bonds' holding by (large) non-financial corporations (through foreign subsidiaries) occurred after the 2008 financial crisis. In most cases, the percentage of corporate bonds over investment portfolio grew with respect to one decade ago, reaching also peaks above 50% (e.g. Apple, Cisco, Oracle and Cigna. Google and Facebook are around 20%, while Amazon only the 10%. Curiously, Microsoft actually inverted the trend.)[7]. How this new financialization phenomenon is affecting (and will affect) the economy is still unclear: financial assets seem to have a controversial effect on capital investment (financial profits appear to be beneficial for new investment in both physical capital

[3]Greenwood and Hanson (2013) use the ratio between non-investment grade bonds' issuance and total corporate bonds' issuance to calculate the excess corporate bond returns.

[4]Monetary financial institutions, insurance and pension funds, investment funds and others.

[5]Çelik, Demirtas, and Isaksson (2020) pg. 6.

[6]See Çelik, Demirtas, and Isaksson (2020) Table 14 pg. 21.

[7]See Çelik, Demirtas, and Isaksson (2020) Table 22 pg. 33.

and intangible capital, whilst current financial investment decisions crowd them out[8]). Existing financialization literature involving ABMs involves the modelling of more broadly studied financialization phenomena, such as the shareholders' value orientation of corporations: Dawid, Harting, and van der Hoog (2019) for example show how managers' share based remuneration negatively impact on productivity and wages, also through investors expectations that boost share prices and further increase managers' remuneration; Guerini, Harting, and Napoletano (2020)) adds that share repurchase is itself the outcome of increasing stock based remuneration, confirming the slowdown in technical progress when firms' governance structure leaves room to short-term investors. Although these studies highlight the importance of including heterogeneity among firms' employees (workers vs. managers) and firms' ownership, stressing the negative role that managers' share based remuneration scheme have on the real economy, we left it apart for the moment for two main reasons: (i) the model here presented is quite complex, so that we preferred to remain stick to the basic CATS model, which does not pose ownership problems (there is one owner per firm) neither entails differences among workers; (ii) we want to focus on the effects of firms being investors and thus analyze a financialization mechanism that does not include broadly studied phenomena as share buybacks and managers' remuneration. Rather, this chapter tries to enrich existing literature on the finance-growth nexus using macro ABMs, where corporations become creditors next to banks. As far as we know, no paper has been produced to investigate this financialization channel, neither much empirical investigation has been done so far. The relationship between credit and growth in ABM context has been addressed by Fagiolo, Giachini, and Roventini (2020), but only concerning bank credit. The model confirms the ability of finance in fostering technological progress, but also shed some light on growth criticalities arising from excessive credit. We want to check whether such conclusions change when not only banks but also companies give credit through bonds' purchasing. As far as we are concerned, an ABM has been created for bonds' trading (Braun-Munzinger, Liu, and Turrell (2018)). In our model, however, bonds are not assumed to be traded (therefore we will not observe bonds' price movements) and only firms can take on the role of investors: we want to see what happens when corporations buy corporate bonds.

2.3 Theretical Model

2.3.1 The Model's Environment

The model is composed of households, firms, Government and one bank only. Households -who consume the homogeneous consumption good- are divided into workers, who provide labor to firms and receive labor income, and capitalists, who receive dividend income. The latter own firms (there is one capitalist per firm) and recapitalize them if bankruptcy occurs. Firms are also divided into consumption good firms (downstream or c-firms) and capital good producers (upstream or k-firms), but in order to focus the analysis on intangibles only, physical capital,

[8] In Orhangazi (2008) financial profits do not have a clear effect on tangible capital expenditure: overall the variable seems to be irrelevant, but turns negative and significant for large firms, whilst positive for small firms.

K^{phy}, is treated as an endowment (and therefore is not produced), while intangible capital, K, is produced by k-firms, which perform R&D[9]. R&D expenditure is the only firms'tool to engage in an innovation processes, which is here shaped in a Schumpeterian framework, where new entrants have advantages/disadvantages with respect to incumbents (as in Dosi, Fagiolo, and Roventini (2010)) and where firms decide the intensity of their R&D effort on the basis of (i) their position relative to the technological frontier, (ii) the entry threat and (iii) competition among incumbents –which is a novelty in AB models dealing with technological progress. If a k-firm does not have enough liquidity to finance its research and/or production processes, it can look for external financing in the form of bank loans and new bonds' issuance. Bonds are bought by liquid firms operating in the other sector[10] seeking for additional profits. Both types of firms can be credit rationed and, according to their ability to repay debt, they are classified into Minskian hedge, speculative or Ponzi units. If a firm is in a Ponzi position, it is assumed to go bankrupt, while a speculative position allows to re-negotiate debt. The second way a firm can go bankrupt is through negative equity, as usual. Financial fragility plays a crucial role in determining the cost of debt and if bankruptcy occurs, new firms, recapitalized by capitalists, enter the market such that we end up having a dynasty of firms (i.e. the number of firms is fixed). The labor market, the consumption-good market, the bonds' market and the capital-good market are governed by search and matching mechanism. Firms in both sectors are assumed not to know their demand curve and to have some market power (prices are set according to a mark-up rule) in their local market. Finally, workers are assumed to be all the same, meaning that skills play no role in this model and they are paid a wage uniform across firms in the same sector (the wage rate changes according to labor productivity growth – which depends on innovation – in the respective sector). For simplicity, unemployed workers accept the first job they are offered. Innovation has an impact on workers through increased labor productivity. The sequence of events is summarized as follows:

1. At the end of the period, on the basis of two market signals, i.e. inventories and average price of the consumption/capital good, c-firms and k-firms set their desired levels of production. At the beginning of each period, then, c-firms set their labor demand on the basis of their desired level of output. They also set the level of investment in intangible capital. K-firms, instead, discover whether they can access innovation or not. Labor demand of k-firms is determined on the basis of desired production and R&D effort (which constitutes in wages paid to researchers) set at the end of the previous period. If firms do not have enough internal funds to finance research/investment and production, they ask for external finance in the form of bank loans and/or newly issued bonds.

2. The bank extends loans to k-firms and c-firms and liquid firms buy bonds from bonds'

[9]In this preliminary work, despite the presence of the public sector, basic research and its spillover effects are left apart.

[10]C-firms buy bonds issued by k-firms or vice-versa, because it is not reasonable to assume that companies in the same sector buy each others' bonds: k-firms have no interest in investing in other k-firms innovations stemming from R&D because they do not employ capital but only labor; c-firms have no clue in financing competitors' production, since the good is homogeneous.

issuers. Once they receive credit, c-firms and k-firms go on the labor market. The government pays subsidies to unemployed. C-firms start producing $Y_{i,t}$ with employed workers and available capital stock, while k-firms produce $K_{j,t}$ and discover whether the innovation has been a success or a failure.

3. The search and matching mechanism takes place and c-firms sell their consumption good to consumers, while k-firms sell their intangible capital good to c-firms. Capital good sold will be available for use next period.

4. At the end of the period, firms have to pay interests, return principal repayments and pay taxes. Dividends follow. If equity turns negative or the firm is in a Ponzi position, it goes bankrupt and is replaced by a new firm. Surviving k-firms and new k-entrants set their level of R&D effort according to Schumpeterian rules.

2.3.2 Households

In order to overcome the issue of ownership rights to be attributed to heterogeneous households owning firms and supplying labor, following Assenza, Delli Gatti, and Grazzini (2015), households are divided into capitalists, $f = (1, 2, .., F)$, and workers, $h = (1, 2, .., H)$. The latter provide units of labor to k-firms and c-firms receiving labor income, $w_{f,t}$, and consume the homogeneous consumption-good produced by c-firms. Labor income is uniform across agents employed in the same sector but evolves in time according to labor productivity growth in each sector[11]. Capitalists instead, own firms: at t=1, each capitalist is randomly assigned one firm (either c-firm or k-firm), which he will own from that moment onward. Capitalists' income, therefore, consists in dividends paid by the firm he owns: $\tau^{Div}\pi_{f,t}$, with $\tau^{Div} \in (0, 1)$ being the dividend payout ratio and $\pi_{f,t}$ firms' profits. For the sake of simplicity, capitalists also recapitalize a new firm when a bankrupt firm exits the market. Households' income will be therefore:

$$Y_{c,t} = \begin{cases} w_{f,t} & \text{if } c = \text{h} \\ \tau^{Div}\pi^{after\ tax}_{f,t-1} & \text{if } c = \text{f} \end{cases} \tag{2.1}$$

If a worker is unemployed, he visits randomly Z_e firms and accepts the first job offer he finds[12]. If any of the Z_e firms has no open vacancy, he remains unemployed and use his dis-savings for consumption. If a worker becomes unemployed in period t, he starts looking for another job in the same period. There are no firing costs for firms and unemployed workers are economically sustained by Government subsidies. Consumption is determined in a bounded rationality

[11]This choice is motivated by the fact that by keeping the wage rate uniform across agents in both sectors, due to technology specification of c-firms, the increase in labor productivity in the c-sector is much lower with respect to the increase in the wage rate (which is pushed by a faster labor productivity growth in the k-sector). This causes a linear increase in unit labor costs for c-firms and, at the same time, a decrease in unit labor costs for k-firms. For this reason, the wage rate has been diversified for the two different sectors.

[12]Since firms belonging to different sectors offer different wages, one could add a preferential mechanism related to individual reservation wage.

setting as follows:

$$C_{c,t} = \bar{Y}_{c,t} + \chi M_{c,t} \tag{2.2}$$

where future expected income is proxied by $\bar{Y}_{c,t}$, *human wealth*[13], while $M_{c,t} = M_{c,t-1} + Y_{c,t} - C_{c,t}$ represents households' financial wealth, deposited at the bank. The interest rate on deposits is nil and if households do not receive any income financial wealth is de-cumulated to keep consuming[14]. According to the search and matching mechanism, each household can visit Z_c selected c-firms and buys from the ranked c-firms charging the lowest prices until his consumption budget is over. If this does not happen and the consumer does not spend everything after visiting all the selected number of c-firms, he puts his involuntary savings into deposits.

2.3.3 The Production Sector

Profit maximization is ruled out in the production sector: firms do not know their actual demand schedule and therefore they cannot calculate their marginal revenue function. The production sector, hence, is characterized by imperfect information, which allows to model production and pricing decisions in a boundedly rational way: desired production is set according to market feedbacks such as excess demand/supply (i.e. *involuntary inventories*) and average price, while pricing change according to a simple rule of a variable mark-up over unit labor costs. Two considerations follow: (i) the variable mark-up is able to capture changes in the market share of each firm but even if firms can behave monopolistically in their local market, they tend not to run away from average prices and (ii) if a firm's mark-up causes a price fall below its average costs, the firm is forced to set a price equal to average costs.

K-firms

Since tangible capital is assumed to be constant and uniform across c-firms, capital-good firms, $j = (1, 2, ..., J)$, only produce intangible capital goods to be sold to consumption-good firms by means of labor only. Intangible capital is a source of heterogeneity in this model, given that it can entail different levels of capital productivities $A_{j,t}$, stemming from innovation.

Mainly following the status quo process of CATS models[15], at the end of each period, each k-firm observes the average price of intangible capital p_t^{κ} and the level of involuntary inventories (i.e. the *forecasting error*) $\Delta_{j,t}^{\kappa} = K_{j,t} - K_{j,t}^{D}$, where $K_{j,t}^{D}$ represents actual demand. These two signals will be used to formulate the level of desired output, $K_{j,t+1}^{*}$. If the forecasting error is positive, it means that the j-th k-firm was expecting higher sales and hence there is excess supply. If it is negative, the j-th k-firm has underestimated demand giving rise to excess demand. No forecasting error means that demand=supply, i.e. there is equilibrium in the capital goods market. Positive involuntary inventories are stored and are assumed to fully

[13]see Assenza, Delli Gatti, and Grazzini (2015): $\bar{Y}_{c,t} = \xi^{hw}\bar{Y}_{c,t-1} + (1-\xi^{hw})Y_{c,t}$, being $\xi^{hw} \in (0,1)$ a memory parameter.

[14]From permanent income hypothesis

[15]In particular, Assenza, Delli Gatti, and Grazzini (2015) and Delli Gatti and Grazzini (2020), which define the status quo as the pair of firm's price and current production $(P_{f,t}, Y_{f,t})$.

depreciate after one year. The value of capital inventories is calculated based on their unit production costs and, for tractability motives, it is also assumed that stored capital inventories can be converted into more productive capital at zero costs in case a new innovation occurs in the subsequent periods. The benchmark scenario is the long-run equilibrium: $p^{\kappa}_{j,t} = p^{\kappa}_t$ and $K_{j,t} = K^D_{j,t}$. The fact that the firm has to rely on market signals to fix production is a way to deal with uncertainty about the actual demand schedule. The final aim of k-firms is that of minimizing the forecasting error. Depending on the two market signals $\Delta^{\kappa}_{j,t}$ and p^{κ}_t, k-firms can decide to change either the price charged either the quantity to produce[16], so they set a level of desired production at the level of expected demand minus stored inventories, $ivt_{j,t-1}$:

$$K^*_{j,t+1} = K^e_{j,t+1} - ivt_{j,t-1} = \begin{cases} (K_{j,t} + \nu^K(\Delta_{j,t})) - ivt_{j,t-1}, & \text{if } \Delta_{j,t} \leq 0 \; and \; p^{\kappa}_{j,t} > p^{\kappa}_t \\ (K_{j,t} - \nu^K(\Delta_{j,t})) - ivt_{j,t-1}, & \text{if } \Delta_{j,t} > 0 \; and \; p^{\kappa}_{j,t} < p^{\kappa}_t \end{cases}$$

Concerning prices, a novelty with respect to the CATS model is introduced in the status quo process in order to harmonize it with the majority of macro ABMs: given that the k-sector (as the c-sector) is assumed not to be perfectly competitive: each k-firm behaves as a monopolist in its local market by applying a mark-up, $\mu_{j,t}$ over unit labor costs, $uc_{j,t} = \frac{w_{j,t}}{a^{\kappa}_{j,t}}$. The equation for prices, thus, takes an explicit form:

$$p^{\kappa}_{j,t+1} = (1 + \mu^{\kappa}_{j,t+1}) uc_{j,t+1} \tag{2.3}$$

In case of (i) excess demand and excessively low prices, and (ii) excess supply and prices above average price, k-firms can reset their price (and not desired production) by increasing/decreasing the mark-up according to a trivial behavioural rule, similar to Caiani, Russo, and Gallegati (2019):

$$\mu^{\kappa}_{j,t+1} = \begin{cases} \mu^{\kappa}_{j,t}\big(1 + FN_k\big), & \text{if } \Delta^{\kappa}_{j,t} \leq 0 \; and \; p^{\kappa}_{j,t} < p^{\kappa}_t \\ \mu^{\kappa}_{j,t}\big(1 - FN_k\big), & \text{if } \Delta^{\kappa}_{j,t} > 0 \; and \; p^{\kappa}_{j,t} > p^{\kappa}_t \end{cases}$$

where FN_k is randomly taken period to period and for each different k-firm from a Folded Normal distribution with parameters $(\mu_{FN_k}, \sigma^2_{FN_k})$. The above formulation for prices allows to make distinctions between possible gains tied to market power, captured by the mark-up and those due to lower unit labor costs, which decrease as individual firms' labor productivity increases as a consequence of technological progress.

Production of the Capital Good

K-firms produce intangible capital using labor as the only input:

$$K_{j,t} = a^{\kappa}_{j,t} N_{j,t} \tag{2.4}$$

[16]See Assenza, Delli Gatti, and Grazzini (2015), who also cite Bhaskar, Machin, and Reid (1993) and Kawasaki, McMillan, and Zimmermann (1982) to empirically support this price/quantity decision rules.

where $a^{\kappa}_{j,t}$ is the labor productivity parameter for k-firms. Notice that unit labor costs differ from firm to firm uniquely in the labor productivity: as $a_{j,t}$ increases after successful innovation/imitation, the unit labor cost decreases. Labor productivity, hence, does not depend on employees' skills (which are left apart here), but on the j-th k-firm position on the technological frontier. Firms with similar labor productivity are said to be *neck-and-neck*, since they also have similar unit labor costs[17].

The Innovation Process

At the end of the period, k-firms set their desired level of R&D for next period:

$$RD_{j,t+1} = z_{j,t}\pi_{j,t} \tag{2.5}$$

This formulation is very similar to that of Dosi, Fagiolo, and Roventini (2010), that, however, link R&D expenditure to past sales with a fixed fraction z. Here the intensity of R&D effort, $z_{j,t}$, is assumed to be variable and proportional to profits (to allow financial profits to have a direct impact on R&D). The amount of desired R&D expenditure is then split between innovation and imitation, as in Dosi, Fagiolo, and Roventini (2010):

$$IN_{j,t+1} = \epsilon RD_{j,t+1} \tag{2.6}$$

$$IM_{j,t+1} = (1-\epsilon)RD_{j,t+1} \tag{2.7}$$

Obviously, if a k-firm is at the frontier, all R&D resources will be used to further innovate (i.e $\epsilon = 1$). R&D expenditure is fully used to pay researchers the uniform sectorial wage. Access to innovation/imitation is governed by a Bernoulli process, with probability parameters θ^{IN}, θ^{IM}. These probabilities depend on the amount of R&D a firm has set at the end of the previous period. Indeed, it is important to stress the fact that when they set the level of R&D, k-firms do not know whether they will have access to innovation or not during next period, but they know that the probabilities $\theta^{IN}_{j,t}$ and $\theta^{IM}_{j,t}$ of entering the innovation and imitation processes, respectively, depend on the level of R&D they choose. Such parameters are thus designed in a way that guarantees higher likelihood to innovate/imitate as firms spend in R&D (as in K+S literature):

$$\theta^{IN}_{j,t} = 1 - e^{-\zeta^{1}_{j,t} IN_{j,t}} \tag{2.8}$$

$$\theta^{IM}_{j,t} = 1 - e^{-\zeta^{2}_{j,t} IM_{j,t}} \tag{2.9}$$

with $0 < \zeta^{1,2}_{j,t} \leq 1$ being two parameters representing *learning* of incumbents, which in the present work is assumed to be endogenous, increasing as new innovations/imitations take place and decreasing with time if no innovation occurs. This approach represents a novelty with

[17] The expression is taken from Aghion, Bloom, Blundell, Griffith, and Howitt (2005) and will be of some practical use for the Schumpeterian mechanism later on.

respect to the K+S model and takes the form of an exponential decaying function:

$$\zeta_{j,t}^{1,2} = (\zeta_{j,t-1}^{1,2} + HV(a_{j,t}^{\kappa,IN/IM} - a_{j,t-1}^{\kappa}))e^{-\Delta t(1/15)} \tag{2.10}$$

with HV being the Heaviside step function, which assigns value 1 if labor productivity stemming from the innovation/imitation process has improved, 1/2 if it is the same as the previous period one and 0 if it has worsened[18]. Equation (10) crucially determine (i) individual access to innovation/imitation for each k-firm (the higher the learning parameter, the higher the likelihood to access the process) and (ii) on aggregate, barriers to entry. Conceptually following Dosi, Fagiolo, and Roventini (2010), the *cumulative learning of incumbents* influences new entrants' dynamics. The way in which the evolution of the $\zeta_{j,t}^{1,2}$ parameter determines the advantage or disadvantage of new entrants vs. incumbents, can be illustrated only after discussing the second step of the innovation process of incumbents. Once the j-th k-firm has had access to the process, research takes place and reveals through entailed productivities:

$$A_{j,t}^{IN/IM} = A_{j,t-1}(1 + x_{j,t}) \tag{2.11}$$

$$a_{j,t}^{\kappa,IN/IM} = a_{j,t-1}^{\kappa}(1 + x_{j,t}) \tag{2.12}$$

where the variable $x_{j,t}$ is randomly drawn from a Beta(α_x, β_x) distribution over the support $[\underline{x},\ \bar{x}]$). K-firms then compare the entailed productivity of capital after innovation and/or imitation with their previous entailed productivity of intangible capital and choose to produce the one with the highest value. If an innovation is successful, indeed, the resulting entailed productivities are higher that the previous ones and innovative capital produced will entail the new productivity of capital, $A_{j,t} = max\{A_{j,t}^{IN}, A_{j,t}^{IM}\}$, and labor, $a_{j,t}^{\kappa} = max\{a_{j,t}^{\kappa,IN}, a_{j,t}^{\kappa,IM}\}$; otherwise the old productivity is preserved. Back to the Schumpeterian mechanism, if the cumulative new learning stemming from the innovation process of incumbents increases, there will be higher cumulative advantage of incumbents and new entrants will face higher entry barriers: the disadvantage of new entrants with respect to incumbents is modeled by shifting the Beta distribution rightward when new firms (replacing bankrupted ones) are initialized, whilst the advantage of new entrants is given by shifting the Beta distribution leftward. As a further implementation of the K+S model – which applies the Schumpeterian mechanism only to the dynamics concerning entry and exit – consider now the dynamics among incumbents. To frame this environment, take the intensity of R&D effort, $z_{j,t} \in [0, 1]$, and endogeneize it as well. At the end of period k-firms know:

- their *distance to the frontier*, $DF_{j,t}$: how far a firm's output is from the technological frontier (i.e. the ratio between the productivity embodied into the j-th k-firm's produced capital and the one embodied in the most innovative capital produced in the economy);
- the level of product-market competition, $PMC_{j,t}$: what is the level of competition among

[18] If labor productivity worsens during the innovation/imitation process, the firm will consider that innovation as a failure and keep the previous one with its previous level of labor productivity.

incumbents (i.e. are there neck-and-neck firms?);

- next period entry threat: can potential new entrants be an effective threat to last innovators? .

These three ingredients constitute the basis of the complete Schumpeterian framework on which beliefs on $z_{j,t}$ are constructed. The story is as follows: a firm is willing to innovate if it can attain post-innovation monopoly rents. As well explained by Aghion and Howitt (2006), these will depend on (i) product-market competition among incumbents (PMC) and (ii) the threat represented by potential new entrants, represented for simplicity by the Herfindahl-Hirschman Index for market concentration (high levels of market concentration allow k-innovators to relax the new entrants' threat). New entrants enter with the average market productivities, updated according to a random draw from a Beta distribution, whose parameters are shifted period to period according to whether they are in a position of advantage or disadvantage. They also set their R&D effort as a benchmark fraction $\bar{z}$ of their liquidity[19]. Concerning $PMC_{j,t}$: for the sake of simplicity, assume that k-firms know incumbents' labor productivities: when two or more k-incumbents have similar unit labor costs, there is product market competition (high neck-and-neckness). A crucial issue at this point is to determine each firm's *distance to the frontier* in order to be able to assess the different prevailing effects which influence k-firms' decisions. Following Schumpeteiran new growth theories, define $A_t^f = max\{A_{t-1}^f, A_{j,t}^{max}\}$ as the technological frontier in the economy[20], which becomes known soon after production; then:

$$DF_{j,t} = \frac{A_{j,t}}{A_t^f} \tag{2.13}$$

represent j-th k-firm's distance to the frontier, similar to Acemoglu, Aghion, and Zilibotti (2006). A value of $DF_{j,t} = 1$ means that the j-th k-firm is on the technological frontier (i.e. there is no distance). As $DF_{j,t}$ falls below unity, the distance to the frontier increases. Having all ingredients, the Schumpeterian framework is now simplified as follows:

CASE 1: for $DF_{j,t} = 1$:

1a) No PMC implies that efforts in R&D will be low: incumbent innovators do not look for drastic innovations to escape competition, since they are currently enjoying monopolistic profits and have no neck-and-neck competitors. Their aim is, at maximum, to implement future innovaitons to make the *appropriability effect* to last in time. This is true for low entry threats. The intensity of R&D effort is minimum and equal to the benchmark level: $z_{j,t} = \bar{z}$.

1b) If competition among incumbents is still nil but the entry threat is relevant, then the innovator will enhance R&D efforts to make drastic innovations and *escape entry*[21]. The intensity of R&D effort can double the benchmark level: $z_{j,t} \in (\bar{z}, 2\bar{z})$.

[19] New entrants do not have profits.

[20] $A_{j,t}^{max}$ is the maximum entailed productivity among all k-firms which innovated in period t.

[21] Entry will take place in any case, but new entrants will face a disadvantage.

1c) If the entry threat is still important and the firm has many neck-and-neck competitors (because for example the innovation has not gone too far from the previous frontier), efforts to increase R&D will be substantial in order to both *escape competition* and *escape entry*. The intensity of R&D effort can again double the benchmark level: $z_{j,t} \in (\bar{z}, 2\bar{z})$.

1d) If there is PMC and the entry threat is low, the *escape competition effect* dominates and k-firms try to increase R&D to make drastic innovations and gain a monopolistic position. The intensity of R&D effort can again double the benchmark level: $z_{j,t} \in (\bar{z}, 2\bar{z})$.

CASE 2: for $DF_{j,t} < 1$

2a) and 2d) Irrespective of PMC, k-firms try to reach the innovator and engage in drastic R&D only if the entry threat is nil. The *escape competition* effect works among non-innovator incumbents to catch the technological frontier. The intensity of R&D effort can double the benchmark level: $z_{j,t} \in (\bar{z}, 2\bar{z})$.

2b) and 2c) If there is a high entry threat, the *discouragement effect* rules out R&D efforts due to the fact that new entrants will be endowed with a close to frontier technology (i.e. new entrants' workers have high labor productivity). The intensity of R&D effort takes its lowest values, with a minimum of 0: $z_{j,t} \in (0, \bar{z})$.

To sum up, at the end of the period k-firms receive signals on their distance to the frontier, on $PMC_{j,t}$ and on entry threat; they get to know which effect is going to dominate and decide the intensity of the R&D effort, $z_{j,t}$, accordingly. In case the j-th k-firm is on the frontier, its behaviour will be the one described in CASE 1; whilst if the j-th k-incumbent is not on the frontier it will behave as in CASE 2:

CASE 1: $DF_{j,t} = 1$

	No Entry Threat	**Entry Threat**
PMC	1d) Drastic R&D *escape competition*	1c) Drastic R&D *escape competition* & *escape entry*
No PMC	1a) Implement R&D *appropriability*	1b) Drastic R&D *escape entry*

CASE 2: $DF_{j,t} < 1$

	PMC		
	2d) Drastic R&D *escape competition*	2c) No R&D *discouragement*	
No Entry Threat			**Entry Threat**
	2a) Drastic R&D *escape competition*	2b) No R&D *discouragement*	
	No PMC		

Search and Matching for K-firms

Once the capital good market opens, c-firms willing to invest visit their previous seller[22] and a fixed number Z_k of k-firms. The probability of being visited is higher for k-firms close to the frontier and lower for those far from the frontier and is calculated using a logistic probability function: $pr^{visit}_{j,t} = 1/(1 + e^{b_{j,t}(0.5-DF_{j,t})})$. The introduction of the probability of being visited can be motivated by assuming that successful R&D efforts are accompanied by any sort of advertising (especially in the IT sector) or are simply "followed" by c-firms interested in buying innovative intangible capital, thus enlarging the platform of potential clients ($b_{j,t}$ has higher values for innovators). Visited firms are then ranked according to a subjective measure of attractiveness, similarly to Caiani, Russo, and Gallegati (2019): given the charged price of capital and the expected unit cost associated to the intangible capital that the i-th c-firm would face if it acquires it, $MA = (uc^e_{i,t} + p_{j,t})$. If the new potential seller's measure of attractiveness is lower than the old partner's one, then the i-th c-firm will switch to the new supplier with probability pr^{switch}_k:

$$pr^{switch}_k = \begin{cases} 1 - e^{\epsilon^{switch}_k \left(\frac{(MA^{new} - MA^{old})}{MA^{new}}\right)}, & \text{if } MA^{new} < MA^{old} \\ 0, & \text{otherwise} \end{cases}$$

If the supply of the chosen k-firm is not enough to cover c-firm's planned investment, the i-th c-firm will buy also from the second-ranked k-firm, and so on. In case the number of firms to be visited is over and the i-th c-firm still has some unsatisfied demand for intangible capital (i.e. the actual capital stock purchased will be lower than planned investment), the corresponding amount of budget is saved.

[22]This preferential attachment is added to allow for some customer fidelization.

C-firms

Price and quantity decisions in the c-sector are very similar to those of k-firms: c-firms look at the two market signals, the *forecasting error*, $\Delta_{i,t}$, and the average price of the consumption good, p_t and they decide the quantity to produce by setting *desired production*, $Y^*_{i,t+1}$, to the level of *expected demand*. Differently from k-firms, c-firms are not assumed to store their inventories. C-firms, hence, set their desired quantity to be produced according to the following adaptive rule:

$$Y^*_{i,t+1} = Y^e_{i,t+1} = \begin{cases} Y_{i,t} + \nu^Y(-\Delta_{i,t}), & \text{if } \Delta_{i,t} \leq 0 \; and \; p_{i,t} > p_t \\ Y_{i,t} - \nu^Y(\Delta_{i,t}), & \text{if } \Delta_{i,t} > 0 \; and \; p_{i,t} < p_t \end{cases}$$

where $\nu^Y \in (0,1)$. As in the k-sector, current production $Y_{i,t}$ may be different depending on credit: if the firm incurs in credit rationing when trying to finance production externally, then current production will differ from desired production. Moreover, due to adjustment costs, investment cannot potentially occur in any period and c-firms cannot invest any time they need more capital to produce the desired quantity. The rate of capital utilization is adjusted in every period depending on the desired quantity to be produced and the actual stock of capital[23]. Prices are set as a mark-up over unit labor costs $c_{i,t} = \frac{w_{i,t}}{a_{i,t}}$, where the variable mark-up evolves following the same rules as in the k-sector::

$$\mu_{i,t+1} = \begin{cases} \mu_{i,t}\big(1 + FN_c\big), & \text{if } \Delta_{i,t} \leq 0 \; and \; p_{i,t} < p_t \\ \mu_{i,t}\big(1 - FN_c\big), & \text{if } \Delta_{i,t} > 0 \; and \; p_{i,t} > p_t \end{cases}$$

where, again, FN_c is a random number picked from a folded normal distributions with parameters $(\mu_{FN_c}, \sigma^2_{FN_c})$. Prices are set accordingly:

$$p_{i,t+1} = (1 + \mu_{i,t+1})c_{i,t+1} \tag{2.14}$$

The price set, however, cannot be lower than average costs (which now include the cost of capital) and since there is an implicit competition *à* la Bertrand shaped by the search and matching mechanism, c-firms are forced to set prices not too far from the average price, if they want to avoid consumers switching to other competitors selling at lower prices.

Production of the Consumption Good

Each c-firm is endowed with a constant amount of physical capital K^{phy} and buys only intangible capital good from k-firms, to produce the homogeneous consumption good by means of labor and capital in fixed proportions[24]. C-firms thus have a Leontief technology, which, at

[23] See Assenza, Delli Gatti, and Grazzini (2015) for details and examples.

[24] We could have ignored physical capital and simply included only intangible capital in the production function. However, we wanted to introduce a timid attempt to deal with both tangible and intangible capital, since we believe that the time to address a broader definition of capital is at hand for economists: looking only at (the decreasing) physical capital stock or at physical capital expenditure, leaves a great portion of the story (rising intangible stock) untold

full capacity, takes the form:

$$\hat{Y}_{i,t} = min\{a_{i,t}N_{i,t}, \bar{\kappa}_{i,t}K^{ces}_{i,t}\} \tag{2.15}$$

where the productivity of capital, $\bar{\kappa_{i,t}}$, linearly shapes labor productivity $a_{i,t} = l * \bar{\kappa}_{i,t}$ (l is the exogenously fixed capital-labor ratio) and where $K^{ces}_{i,t}$ is a firm-level aggregator for capital[25] of the form:

$$K^{ces}_{i,t} = \left[b^{phy}(K^{phy})^{\rho} + b^{rd}(K_{i,t})^{\rho}\right]^{\frac{1}{\rho}} \tag{2.16}$$

with b^{phy} and b^{rd} representing the tangible and intangible, respectively, capital factor distribution (positive) parameters ($b^{phy} + b^{rd} = 1$) and ρ being the parameter associated with the elasticity of substitution, $\sigma = \frac{1}{1-\rho}$. Since tangible capital and intangible capital are assumed to have a weak substitutability, perfect complementarity and unitary substitutability are ruled out and $\sigma \in (0, 1)$ is imposed. Now, we know that intangibles entail certain levels of capital productivities, $A_{j,t}$, so that, when a c-firm buys intangible capital, this additional stock with its entailed productivity is added to the current stock and the weighted average of intangible capital productivity is captured by $\bar{A}_{i,t}$ so that[26]:

$$\bar{\kappa}_{i,t}K^{ces}_{i,t} = \left[b^{phy}(K^{phy})^{\rho} + b^{rd}(\bar{A}_{i,t}K_{i,t})^{\rho}\right]^{\frac{1}{\rho}} \tag{2.17}$$

with $\bar{\kappa_{i,t}} = \frac{\left[b^{phy}(K^{phy})^{\rho}+b^{rd}(\bar{A}_{i,t}K_{i,t})^{\rho}\right]^{\frac{1}{\rho}}}{K^{ces}_{i,t}}$.

Assuming abundancy of labor, if production is not put forward at full capacity, we will have:

$$Y_{i,t} = u^{ces}\hat{Y}_{i,t} = u^{ces}\bar{\kappa_{i,t}}K^{ces}_{i,t} \tag{2.18}$$

The rate of capital utilization is used to adjust the capital stock to production: if capital needed to produce the desired quantity is greater than the stock of capital, $K^{ces}_{i,t}$, and therefore $K_{i,t}$ will be used at full capacity; otherwise, the rate of capacity utilization will be adjusted accordingly. The labor requirement is $N_{i,t} = \frac{\bar{\kappa}_{i,t}}{a_{i,t}}K_{i,t}$. Intangible capital depreciates through time; therefore its law of motion is:

$$K_{i,t+1} = (1 - u^{rd}_{i,t}\delta)K_{i,t} + I_{i,t} \tag{2.19}$$

with $u^{rd}_{i,t}\delta$ the actual depreciation rate[27]. $I_{i,t}$ is intangible-capital investment.

Intangible Capital Investment

For simplicity, investment in intangible capital follows the CATS framework for capital investment, so that it allows c-firms to adjust their capital stock. Investment in intangibles entail, however a key property in this framework: it is assumed that intangibles used in production

[25]see Sato (1967).

[26]Since the main interest of this chapter concerns innovations regarding intangibles, I assumed a productivity parameter for physical capital constant and uniform across c-firms and set it equal to 1, so that the growth rate of physical capital productivity is nil. This is the reason why the productivity of tangible capital does not appear in eq. (15)

[27]$u^{rd}_{i,t} = (u^{ces}_{i,t})^{\rho}$ is the rate of capacity utilization of intangible capital.

have important IT features, so that they can be softwares, data or knowledge that by means of algorithms and artificial intelligence can capture consumer preferences and shape consumption. Given that the consumption good is homogeneous, this simply translates into higher advertising (through IT and hence intangibles) and therefore higher probability of being visited in the search and matching mechanism, as will be explained in a while. So, by assumption, it follows that c-firms buying innovative intangibles can reach more consumers. C-firms also face adjustment costs (so that each c-firm can invest only once every two periods, i.e. the probability of investing is γ) and intangible capital is fixed in the short run (indeed, capital purchased in t is available from t+1). The only difference concerns the fact that intangibles are part of the capital aggregator and must be treated accordingly. Each c-firm calculates the average stock of capital used until period t according to the following adaptive rule:

$$\bar{K}^{ces}_{i,t-1} = \xi^{\kappa}\bar{K}^{ces}_{i,t-2} + (1-\xi^{\kappa})u^{ces}_{i,t-1}K^{ces}_{i,t-1} \tag{2.20}$$

with $\xi^{\kappa} \in (0,1)$ being a memory parameter. The weighted average of past utilized capital with exponentially decaying weights, $\bar{K}^{ces}_{i,t-1}$, is then divided by a long run rate of capacity utilization $\bar{u}$, constant and uniform across c-firms, in order to have a capital stock buffer $K^{ces,T}_{i,t} = \frac{\bar{K}^{ces}_{i,t-1}}{\bar{u}}$. There are two different main reasons why c-firms want to hold some stock buffer: (i) to face unexpected demand and (ii) for strategic reasons (excess capacity as deterrent to entry). In this preliminary model, however, there is no room for endogenous and strategic treatment of the capacity utilization rate, although it would be an interesting extension. Given the capital aggregator and being tangible capital fixed (no depreciation), the stock of desired intangible capital to reach the target capital stock is:

$$K^{des}_{i,t} = \left[\frac{\left((K^{ces,T}_{i,t})^{\rho} - b^{phy}(K^{phy})^{\rho}\right)}{b^{rd}}\right]^{1/\rho} \tag{2.21}$$

Intangible capital is subject to depreciation, so that, to replace worn out intangible capital, the i-th c-firm needs: $\frac{\delta}{\gamma}(\bar{u}^{rd})^{\rho}K^{des}_{i,t}$. Investment is then computed as:

$$I_{i,t} = K^{des}_{i,t} + \frac{\delta}{\gamma}(\bar{u}^{rd})^{\rho}K^{des}_{i,t} - K_{i,t-1} \tag{2.22}$$

Search and Matching for C-firms

The c-sector is ruled by a different search and matching mechanism with respect to the one for the k-sector: the number of firms that each consumer can visit, Z_c, is fixed to 2 to ensure Bertrand competition, but the firms consumers visit change in each period (no fidelization mechanism). Again, the probability of visiting the i-th c-firm increases with the quality (measured by the average productivity of capital) of innovative capital of c-firms: c-firms at the frontier or close to the frontier (i.e. they have innovative intangibles) have higher probabilities of being visited with respect of those far from the frontier because of enhanced advertising properties of newly acquired innovative intangibles[28]. C-firms that invested in innovative intangibles, then, might have broader local markets because of information technology intrinsic properties (and related data collecting and advertising). Once selected, households can collect information on the price of the consumption good and rank them. They buy from the firm charging the lowest price and keep buying according to their ranking until (i) their income is over or (ii) there is no more c-firm to be visited. In that case savings are deposited at the bank.

2.3.4 The Credit Market

Assume the pecking order theory to hold, then firms initially finance themselves through internal funds (i.e. accumulated liquidity, $M_{f,t-1}$) and if a financing gap arises, they look for external financing in the form of bank credit and bonds' issuance (in this framework there is no room for new equity issuance given we are interested in the effect of bonds' issuance and purchasing). For c-firms the financing gap is given by the difference (if positive) between wages and capital expenditure with available internal funds:

$$F_{i,t} = max\left\{ w_{i,t}N_{i,t} + p^{\kappa}_{t-1}I_{i,t} - M_{i,t-1}\ ,\ 0\right\} \tag{2.23}$$

For k-firms, the financing gap is given by:

$$F_{j,t} = max\left\{ w_{j,t}N_{j,t} - M_{j,t-1}; 0\right\} \tag{2.24}$$

$F_{f,t}$ therefore represent firms' credit demand. The supply side of the credit market is composed of the banking sector and of a number of investing firms.

The Banking Sector

For the sake of simplicity, there is only one bank representing the entire banking sector and since its behaviour remains unchanged with respect to Assenza, Delli Gatti, and Grazzini (2015) and Delli Gatti and Grazzini (2020), only some key equations are here reported. The single bank in this economy collects firms' and households' deposits and supplies loans to both c-firms and k-firms. The credit line might be lower than the amount asked by the firm and depends on firms' financial fragility. The leverage ratio will measure firms' financial fragility[29]:

$$\lambda_{i,t} = \frac{L_{i,t} + B^c_{i,t}}{E_{i,t} + L_{i,t} + B^c_{i,t}} \tag{2.25}$$

[28]The logistic probability already defined for the k-sector's search and matching mechanism is applied also in the c-sector.

[29]A measure of financial fragility that takes into account the "borrowers' actual ability to generate net cash inflows to honor the debt", as pointed out in Caiani, Godin, Caverzasi, Gallegati, Kinsella, and Stiglitz (2016), should be preferred. However, since the banking sector is entirely taken from Assenza, Delli Gatti, and Grazzini (2015) and since we already had to introduce the bonds' market in the credit market, we decided to keep their measure of financial fragility.

$$\lambda_{j,t} = \frac{L_{j,t} + B^k_{j,t}}{E_{j,t} + L_{j,t} + B^k_{j,t}} \tag{2.26}$$

where $L_{f,t}$ are liabilities in the form of bank loans, $E_{f,t}$ is equity and $B^{c,k}_{f,t}$ are firms' issued bonds. The probability of bankruptcy is then calculated as:

$$pr(\lambda_{f,t}) = \frac{e^{b_0 + b_1 \lambda_{f,t}}}{1 + e^{b_0 + b_1 \lambda_{f,t}}} \tag{2.27}$$

Bankruptcy can occur in two ways: (i) when equity turns negative due to persistent losses and (ii) when firms are in a Ponzi position (in order to avoid persistent negative liquidity). Financial position of firms follow Minsky's classification and a firm is defined to be *hedge*, when it can afford both interests and principal repayments using its actual liquidity[30]; *speculative*, when it can afford only interest payments and need to look for more loans in order to face principal repayments; and *Ponzi*, if it cannot repay the entire debt and must incur in new debt in order to cover at least interest payments. To simplify things to the maximum extent, I assume that, while speculative firms can re-negotiate their debt in order to repay at least bonds' principal, Ponzi firms – unable to repay even interests and/or coupons – are not allowed to ask for new bank loans in order to cover interest and bonds' payments and hence go bankrupt. Speculative positions, thereby, do not have negative consequences on investors, who eventually receive both coupons and principal repayments because the bank provides to the partial or total bond's payment and increases firm's debt accordingly. Speculative position thus can only generate bank loans' repayments delays. Ponzi positions instead give rise to losses: coupons and bonds' repayments remain unpaid causing a loss of liquidity to investing firms and banks will register a loss as well in terms of interests and loan repayment, although it takes the bankrupted firm's remained liquidity. Formally, we have that:

- *Hedge firms*: $M_{f,t} \geq \hat{r}^L_{f,t} L_{f,t} + \phi^L L_{f,t} + \sum i^B_{f,t} B^{(c,\kappa)}_{f,t} + B^{(c,\kappa)\ rep}_{f,t}$.
- *Speculative firms*: $M_{f,t} \geq \hat{r}^L_{f,t} L_{f,t} + \sum i^B_{f,t} B^{(c,k)}_{f,t}$ but $M_{f,t} < \hat{r}^L_{f,t} L_{f,t} + \sum i^B_{f,t} B^{(c,k)}_{f,t} + B^{(c,k)\ rep}_{f,t} + \phi^L L_{f,t}$.
- *Ponzi firms*: $M_{f,t} < \hat{r}^L_{f,t} L_{f,t} + \sum i^B_{f,t} B^{(c,k)}_{f,t} + B^{(c,k)\ rep}_{f,t}$.

where overall loans' interests are $\hat{r}^L_{f,t} = \hat{r}^L_{f,t}\big(1 - \frac{\phi^L L_{f,t}}{L_{f,t}}\big) + r_{f,t} \frac{\phi^L L_{f,t}}{L_{f,t}}$, while the interest applied to the single loan is:

$$r_{f,t} = \mu^L \left[\frac{1 + r/\phi^L}{\Xi(\phi^L, 1/pr(\lambda_{f,t}))} - \phi^L \right] \tag{2.28}$$

being r the risk-free rate and the inverse of the bankruptcy probability being the time to default; ϕ^L is the fraction of bank loans $L_{f,t} = L_{f,t-1} + \Delta L_{f,t}$ to be repaid in each period, with new loans exerted being the minimum between firm's fraction of financing gap it wants to cover with bank loans and the maximum credit the bank is willing to grant (in the latter case there

[30] Before dividends.

will be credit rationing on the banking side):

$$\Delta L_{f,t} = min((1 - x^b)F_{f,t}, \bar{F}_{f,t}) \tag{2.29}$$

For all details regarding Eq.(2.28) and Eq.(2.29), refer to Assenza, Delli Gatti, and Grazzini (2015)). Coupon rates, $i^B_{f,t}$ and bonds issued, $B^{(c,\kappa)}_{f,t}$ that need to be repaid are addressed in the next section. Finally, bank's dividends are equally distributed to capitalists.

Market for Bonds

Firms looking for external financing set the fraction of financing gap they want to cover with new bonds' issuance, $x^b F_{f,t}$, with $x^b \in [0, 1]$ being constant and uniform across firms[31]. Suppose that firms can invest a fraction of past internal funds $\tau^B M_{f,t-1}$ into other sector's firms' bonds. Also the fraction τ^B is set to be constant and uniform across c-firms. This amount is then used to buy government bonds in fraction x^{Gov}, and corporate bonds[32]. Only firms with excess liquidity, able to carry production with no need of external financing, and with non-negative past profits are assumed to have access to financial investments. In order to keep the focus on corporate bonds, Government bonds are assumed to be sold at the end of period, after having received interests[33]. Concerning borrowers, the rate of return on bonds, i^B_f, is predetermined at the time of issuance and reflects k-firm's financial position. In this preliminary work, expectations are left apart and no secondary market is assumed, so that c-firms are forced to hold all bonds they have purchased 'til maturity and there is no discrepancy between the bond yield and the coupon rate (i.e. the interest rate set on bonds remains the same through the holding period). It follows that the price of a bond cannot fluctuate and corresponds to its par value and since it cannot be exchanged, investors have no possibility of realizing capital gains. The bond must be fully repaid after four periods[34].

Issuance of Bonds (Demand Side)

The f-th firm issues a total value of bonds $\Delta B^F_{f,t} = x^b F_{f,t}$, at constant par value, B^{pv}, uniform across firms, such that $N^B_{f,t} = \Delta B^F_{f,t}(B^{pv})^{-1}$ is the total number of bonds issued in the market with $n^B_{f,t} = (1, 2, ..N^B_{f,t})$. Firms belonging to the other sector will buy a discrete number of bonds per each firm it visits, $n^f_{i,t}$. Total demand of bonds per each issuer is given by $\sum_i n^f_{i,t}$. If $\sum_i n^f_{i,t} \leq N^B_{f,t}$ and the inequality is strict, the f-th issuer will collect less financing than planned on the market (and there will be credit rationing on the financial market side). Firms fix the coupon rate on bonds $i^B_{f,t}$, which eventually leads to the coupon to be paid in

[31] Data on US corporations collected on FRED website suggest that nowadays firms split their financing gap almost equally between bank loans and new bonds' issuance. Experiments on x^b will be based on this consideration.

[32] Government bonds' purchase is introduced in order to remain anchored to reality and let investing firms have a more diversified portfolio.

[33] At the end of the period, hence, firms sell Government bonds to the bank.

[34] The fixed 4-periods bond is a tool to simplify the analysis. This is a very restrictive assumption, but necessary to set up the model. Extensions with longer and different durations will be hopefully provided in the future.

each of the subsequent periods – until principal repayment – for each bond sold: $i^B_{f,t}B^{pv}$ There is no difference in the time to maturity, since all bonds must be fully repaid in t+4. At the maturity date, then, the firm has to return the entire par value. The coupon rate is determined by adding a premium to the benchmark (and constant) risk-free rate r. Each firm, knowing its own classification (i.e. credit rating), will set an interest rate which accounts for the risk-free interest rate plus a measure reflecting the riskiness associated to its financial robustness ($pr(\lambda_{f,t})$). Also, credit rating changes over time, depending on whether the economy is in a good state or in economic downturns: there is evidence on the pro-cyclicality of credit rating agencies, which tend to raise corporations' ratings during economic upturns, while downsizing them in periods of crisis (see Auh (2015))[35]. To capture this feature, the interest rate charged on bonds will be adjusted by a parameter λ^{cycle}_t which is greater than 1 if the previous 2 periods had been characterized by negative or nil growth, lower that 1 if in the previous two periods the economy experienced a positive growth and equal to 1 in the intermediate cases. The rate of return on bonds charged by the issuer will therefore simply refer to a risk premium on a risk-free asset, where the risk premium depends on the credit rating sensitivity to business cycles and on firms' financial fragility:

$$i^B_{f,t} = r + \lambda^{cycle}_t pr(\lambda_{f,t}) \tag{2.30}$$

When the credit market closes, firms can observe how many bonds have been purchased and the value of external finance raised through bonds: $\Delta B^{(c,\kappa)}_{f,t} \in (0, \Delta B^F_{f,t})$[36]. The bonds' market is governed by search and matching: c-firms willing to invest can visit a fraction $Z_b k$ of k-firms, while k-firms willing to buy bonds can visit only a fraction Z_b of c-issuers. Even though $Z_b k = F_c$ and $Z_b = Fk$, there might be credit rationing in the financial market due to randomness: for example, if we have only 2 k-firms willing to purchase corporate bonds, but we have 10 c-firms looking for liquidity, it might be that some of them cannote sell their bonds because once the two investors visit them they have already spent all the quota they planned to invest in marketable securities. If investors do not use the entire amount $\tau^B M_{i,t-1}$ they save it back into deposits.

Purchase of Bonds (Supply Side)

Each Investor buys an amount of bonds $n^{\neg f}_{f,t}$ whose value is $n^B_{\neg f,t}B^{pv}$ from the ¬f-th firm, so that the sum of all bonds purchased from different firms gives the total amount of bonds to be

[35] Credit rating agencies (CRA) mainly consider 5 factors in determining the rating: (i) leverage and coverage, (ii) scale, (iii) profitability, (iv) business profile, (v) financial policy. To simplify things to the maximum extent, in this model a fictitious CRA sets the rating depending uniquely on financial fragility. Indeed, "leverage and coverage" hugely determines the final rating, as explained by Çelik, Demirtas, and Isaksson (2020). A credit cycle feedback is, however, introduced in the model: the final interest applied on bonds will take into account CRA tendency to relax rating accuracy in periods of economic growth, leading to higher quality ratings, while they worsen credit ratings in poor periods (see Bar-Isaac and Shapiro (2013), Auh (2015) and Lobo, Paugam, Stolowy, and Astolfi (2017)).

[36] $\Delta B_{f,t} = n^{B_{f,t}} B^{pv}$

added to the current stock of bonds in period t:

$$\sum_{\neg f} n^B_{\neg f,t} B^{pv} = \Delta B_{f,t} \tag{2.31}$$

For each amount purchased, then the coupons that should be received in the following 4 periods are:

$$CP_{f,t} = \sum_{\neg f} n^B_{\neg f,t} i^B_{\neg f,t} B^{pv} \tag{2.32}$$

Principal repayments occur in the 4^{th} period, together with the last coupon.

2.3.5 The Public Sector

The public sector does not consume any of the goods and is not involved in the research process: basic research and its spillover effects are, hence, missing in this economy. Government raises taxes on wages and dividends, $TA_t = t^w w_{f,t} N_t + \sum_f t^\pi \pi_{f,t}$, and gives transfers to unemployed workers according to a replacement rate, cz and the average wage rate in the economy w_t. In order to finance its public debt, when necessary, it issues bonds:

$$US_t = cz \cdot w_t (N_w - N_t) \tag{2.33}$$

whose interests to be paid to investors are:

$$INT_t = r B^{Gov}_{t-1} \tag{2.34}$$

A small fraction of safe bonds are purchased by liquid firms, whilst the rest is purchased by the bank.

2.3.6 Accounting

Households' wealth coincides with non-remunerated deposits at the bank:

$$E_{c,t} = M_{c,t} = M_{c,t-1} + Y_{c,t} - C_{c,t} \tag{2.35}$$

C-firms' balance sheet is represented by the following accounting identity:

$$K^{phy} + v^{rd}_{i,t} K_{i,t} + B_{i,t} + Ivt_{i,t} + M_{i,t} = L_{i,t} + B^\kappa_{i,t} + E_{i,t} \tag{2.36}$$

with $v^{rd}_{i,t}$ representing the book value of intangible capital; $B_{i,t}$ is total financial assets (par value of the stock of purchased bonds not yet matured); $Ivt_{i,t}$ is stored inventories (value); $M_{i,t}$ is liquidity (i.e. deposits), which corresponds to internal funds; $L_{i,t}$ is firm's total debt in the form of bank loans, $B^\kappa_{i,t}$ is debt in the form of issued bonds (held by k-firms) and $E_{i,t}$ is equity (or net worth). It is worth noting that through the purchase of k-firms' bonds, c-firms (i) expand their assets; (ii) increase their available internal funds if the issuer repay its debt, making additional financial profits; (iii) decrease their deposits if the issuer goes bankrupt. Profits of c-firms at the end of period are constituted by operating profits and financial profits:

$$\pi_{i,t} = \pi^{O}_{i,t} + \pi^{B}_{i,t} \tag{2.37}$$

Operating profits are:

$$\pi^{O}_{i,t} = p_{i,t}\ min\{Y_{i,t}, Y^{d}_{i,t}\} + \Delta Ivt_{i,t} - w_t N_{i,t} - v^{rd}_{i,t} I^{r}_{i,t} - \hat{r}^{L}_{i,t} L_{i,t} - \sum i^{B}_{i,t} B^{\kappa}_{i,t} \tag{2.38}$$

with $min\{Y_{i,t}, Y^{d}_{i,t}\}$ being the amount of consumption good actually sold, $v^{rd}_{i,t} I^{r}_{i,t}$ the depreciated value of intangible capital actually used and $\Delta Ivt_{i,t}$ the variation of inventories. Financial profits (or financial revenues[37], constituted by interest payments) of c-firms are given by interests on bonds and coupons paid by solvent k-firms (Fs):

$$\pi^{B}_{i,t} = INT_{i,t} + \sum_{s=1}^{Fs} n^{B}_{s,t} i^{B}_{s,t} B^{pv} \tag{2.39}$$

Internal funds at time t, $M_{i,t}$ are hence described as follows:

$$\begin{aligned} M_{i,t} = M_{i,t-1} &+ (1 - \tau^{Div})\pi_{i,t} + v^{rd}_{i,t} I^{r}_{i,t} - p^{\kappa}_{k,t} I_{i,t} - \Delta Ivt_{i,t} + \Delta L_{i,t} + \Delta B^{\kappa}_{i,t} \\ &- \phi^{L} L_{i,t} - B^{\kappa\ rep}_{i,t} + \left(\sum_{s=1}^{Fs} \Delta B_{s,t-1} - \Delta B_{i,t} \right) \end{aligned}$$

where $\phi^{L} L_{i,t}$ is debt installment (the portion of principal to be repaid in t), $\hat{r}^{L}_{i,t} L_{i,t}$ are the interest payments on loans; $p_{k,t} I_{i,t}$ is expenditure in new intangible capital good evaluated at the current prices; and the last term in brackets is the difference between the par value of bonds at maturity repaid by solvent borrowers in t, $\sum_{s=1}^{Fs} B_{s,t}$, and new purchased bonds of firms in t, $\Delta B_{i,t} = \sum_{f} B^{f}_{i,t}$. $\Delta B^{\kappa}_{i,t}$ is credit from bonds purchased by k-firms.

K-firms' balance sheet identity is instead:

$$M_{j,t} = B_{j,t} + L_{j,t} + E_{j,t} \tag{2.40}$$

Internal funds are given by:

$$\begin{aligned} M_{j,t} = M_{j,t-1} &+ (1 - \tau^{Div})\pi_{j,t} - \Delta Ivt_{j,t} + \Delta L_{j,t} + \Delta B^{c}_{j,t} \\ &- \phi^{L} L_{j,t} - B^{c\ rep}_{j,t} + \left(\sum_{s=1}^{Fs} \Delta B_{s,t-1} - \Delta B_{j,t} \right) \end{aligned}$$

Profits are again given by operating profits and financial profits:

$$\pi_{j,t} = p_{j,t} K_{j,t} - (w N_{j,t}) + \pi^{B}_{j,t} \tag{2.41}$$

[37] there are no costs associated with the financial activity

Finally, net worth in both cases is simply given as:

$$E_{f,t} = E_{f,t-1} + (1 - \tau^{Div})\pi_{f,t} \tag{2.42}$$

When bankruptcy occurs investing firms register a bad debt constituted by unreceived principal repayments and a new firm will then enter the market with a level of equity determined by the capitalist owning the bankrupt who will use part of his financial wealth as equity for a new entrant.

Concerning the bank, its balance sheet is composed as follows:

$$R_t + L_t = M_t + E_t^b \tag{2.43}$$

where R_t represents the bank's deposits as reserves; L_t is total loans extended to firms; M_t is total deposits of firms and households and E_t is the bank's equity. The bank's profits are simply given by the sum of all interest payments of solvent borrowers:

$$\pi_t^b = \sum_{s=1}^{Fs} r_{s,t} L_{s,t} + INT_t \tag{2.44}$$

and equity evolves according to:

$$E_t^b = E_{t-1}^b + \pi_t^b - \sum_{s=1}^{Fn} r_{n,t} L_{n,t} \tag{2.45}$$

2.4 Simulations

Different models are simulated, starting from a baseline model, whose main function is to replicate an economy where companies can only receive bank credit. Bonds (both government bonds and corporate bonds in firms' balance sheets) are then introduced in the model. Results will be presented as single simulations' outcomes or as the mean of 15 runs of Monte Carlo simulations over 1500 periods.Having initialized the model at the best possible scenario (i.e. at full employment), variables are subject to huge initial temporary fluctuations and take some time in order to stabilize. For this reason, time series will be presented from period 400 to 1500. The initialization procedure can be found in Appendix D.4.

2.4.1 Baseline Model Dynamics and Empirical Validation

Before proceeding with experiments concerning the introduction of a corporate bond market, it is worth observing some of the macroeconomic dynamics and microeconomic implications generated by the baseline model and assess its plausibility by comparing it with real data. As shown in Figure 2.1 below – where log levels of real GDP, real consumption and real investment in intangible capital are plotted (top), together with their filtered time series, to isolate cyclical components (bottom) – the simulated model is able to reproduce economic growth.

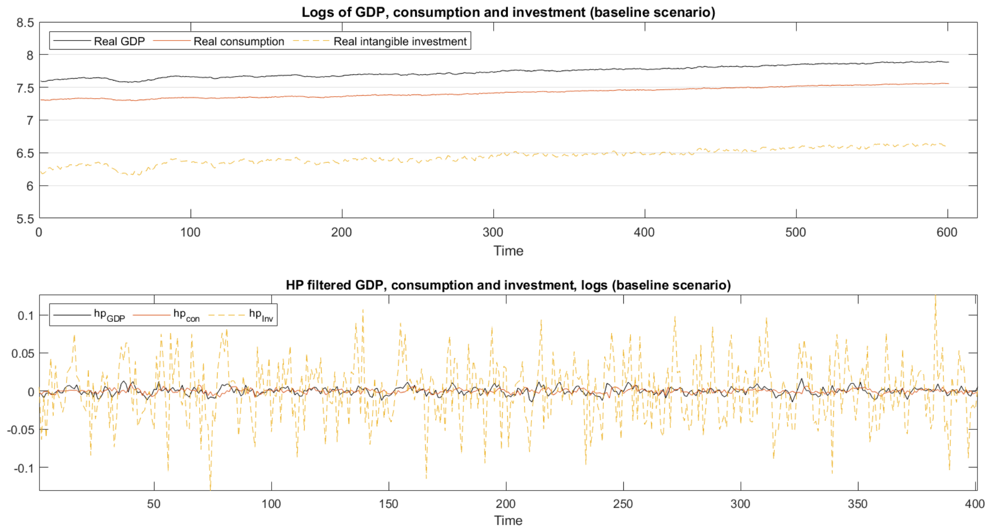


Figure 2.1: **Log levels of real GDP, real consumption and real intangible investment and cyclical components.** Results stem from averaged 15 Monte Carlo simulations. HP filter applied in the bottom panel.

The top panel, indeed, exhibits growing real GDP (black line), sustained by real consumption growth (red line) and intangible investment (yellow dashed line). By later applying the HP filter (bottom panel), we can observe the behaviour of the three variables over business cycles: real output, consumption and investment generally have similar turning points, even though real consumption does not fully co-move with real GDP[38]. The pro-cyclicality of consumption and investment is, however, confirmed and, intangible investment have properties similar to those of physical capital investment in literature (see Stock and Watson (1999)): the HP filtered variables' panel, indeed, shows a greater volatility of investment as compared to output and consumption, as reported also in Table 2.1[39]. Business cycles characterize both growth paths and Figure 2.2 provides some graphical help coming from single simulations to visualize the associated interrelated effects on macro variables:

[38]This particular issue arose once the wage rate has been made non-uniform across sectors. One possible explanation is that workers employed, for instance, in the capital good sector (that on average pays higher wages than the consumption good sector), may find themselves employed in the consumption good sector in the subsequent period if he has been fired. Such a sudden change of earned wage may impact on his personal wealth and expectations on future income and therefore may have effects on human wealth and individual consumption.

[39]This is not surprising, since investment rules are the same as those of CATS model with physical capital. One purpose is to extend the model, get rid of the assumption that forces physical capital to be an endowment and use optimization rules to determine the level of investment in physical capital and the level of investment in intangible capital, given the CES function. A proper measure of intangible investment is still missing.

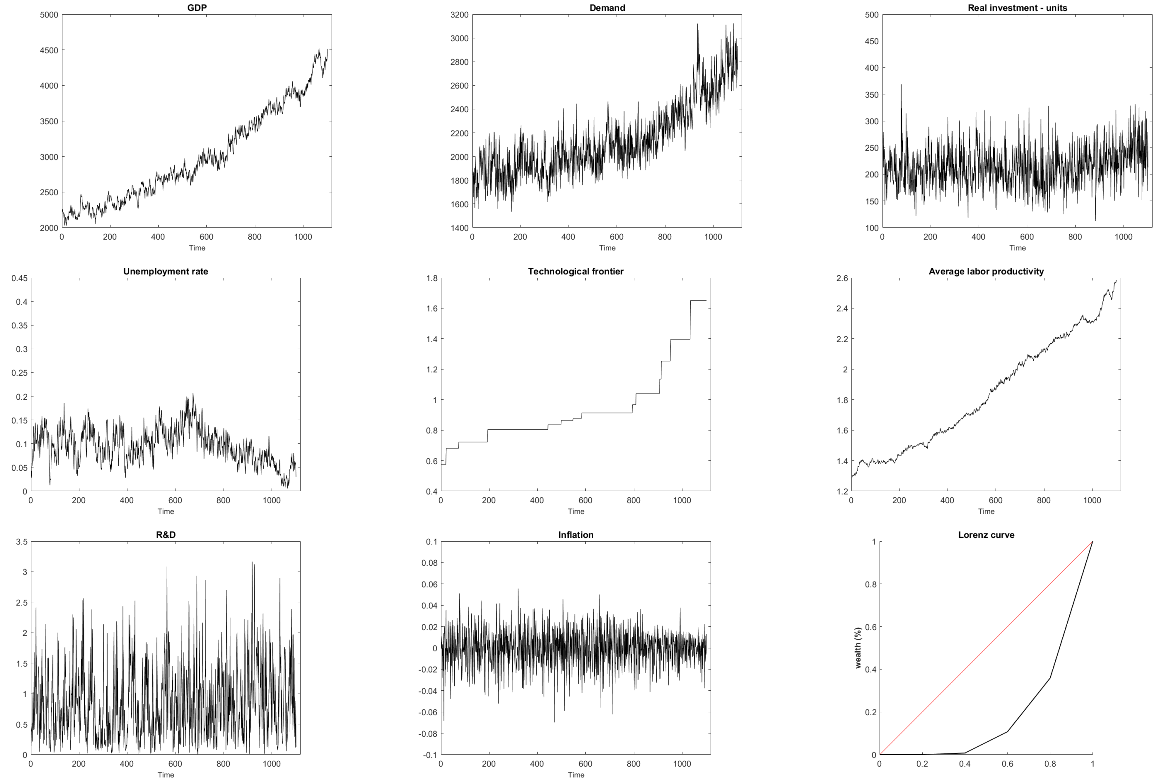


Figure 2.2: **Selected macroeconomic time series and Lorenz curve**. Baseline model's time series taken from individual representative simulations in order to keep business cycles properties.

Growth is endogenously generated through increased productivity of intangibles: the correlation between jumps of the technological frontier and raising GDP can easily be observed (e.g. right after t=1000). The technological frontier, by increasing labor productivity of both capital producers and consumption good producers, opens the way to a series of effects on either the demand side either the supply side of the economy. In the k-sector, successful innovation processes end with increased productivity of workers and higher learning. The latter, will positively impact on next period ability of accessing innovation, perhaps counterbalancing lower investment in R&D due to possible lower profits. Sectorial labor productivity growth determines sectorial wage rates, which thereby cannot grow much faster than labor productivity. This causes dropping unit labor costs for k-firms and more stable unit labor costs for c-firms, due to the fact that consumption good firms own a stock of intangible capital whose average productivity averages out with the unit productivity of the endowed physical stock of capital. It is this overall measure that determines c-firms' workers labor productivity, whose growth trend, subsequently, is lower with respect of that of k-sectors' one. Overall, periods of drastic innovations (as after period t= 1000 in the figures) boosts average labor productivity consistently. When the pace of innovation decelerateslower wages translate into lower aggregate demand. Prolonged periods of productivity stagnation can decrease the learning parameter and hence this makes R&D efforts little prolific, by limiting access to innovation and enhancing barriers to entry. A low speed of high quality produced intangibles, also decreases the speed of consumption good quantities (because of lower labor productivity that in turn make wages to grow very slowly). Since innovation causes a jump in wages, a sudden increase in average costs of production may also cause excessive firing in the very short-run in case the firm is over indebted and especially if the innovation is in the hand of few consumption-good producers resulting in higher unemployment, depressing demand and therefore production (this dynamics can be seen for example before t=600, where there has been some subsequent frontier improvements after a long period of stagnation). As c-firms invest in the last innovative intangible, however, labor requirements readjust and demand increases. Real investment units are volatile but around a trend, while real investment calculated as units of investment multiplied by prices at the base period (not shown in Figure 2.2, but intuitable from 2.1) is increasing because of rising prices of the capital good (despite the drop in unit labor costs average costs tend to grow because of interests payments and k-firms cannot set their price below their average cost). Given the households' separation among workers and capitalists (and the differences in their incomes), some level of wealth inequality was expected.

Finally, Table 2.1 reports standard deviation values and the first lag autocorrelation of selected variables stemming from Monte Carlo parallel simulations: GDP, consumption, unemployment rate, inflation and intangible investment. Figures reporting autocorrelations and cross correlations of simulated time series and real observed time series can be found in the Appendix.

Table 2.1: **Cyclical components' standard deviation and first lag autocorrelation of selected variables of the baseline simulated model (average of 15 Monte Carlo runs).**

	standard deviation	**first lag autocorrelation**
GDP	0.021194	0.59217
consumption	0.01225	0.31283
intangible investment	0.15746	0.11404
unemployment rate	0.056633	0.59691
inflation	0.016067	0.030516

2.4.2 Experiments Including Corporate Bonds' Purchase

A number of different experiments are run on the baseline model in order to investigate three main features: the effect of bonds on (i) economic growth and key macroeconomic variables, (ii) financial stability of the entire system and (iii) liquidity of firms. Experiments results are the average of 15 Monte Carlo simulations run over 1500 periods (first 400 periods not reported in figures). Parameters are set arbitrarily: investors set a fraction τ^B of liquidity to be devoted to financial assets; the financial portfolio will be composed of risky bonds and riskless bonds according to the parameter x^{Gov}=0.5 and issuers can cover up to x^b=0.5 (for c-firms) and $x^b = 0.35$ (k-firms) of their financing gap with new bonds' issuance. Only the parameter τ^B will be changed during experiments, keeping the others at their original value. In *Experiment 1*, all firms set the same fraction of liquidity to be devoted to bonds' purchase; in *Experiment 2*, all firms set the same fraction of liquidity to be devoted to bonds' purchase but the set of parameters is relatively higher with respect to Experiment 1; in *Experiment 3* firms set different fractions of liquidity to be devoted to bonds' purchase: k-firms set $\tau^B =$

(0.0001; 0.001; 0.01), whilst c-firms set $\tau^B = (0.00025; 0.0025; 0.025)$; finally in *Experiment 4* replicates Experiment 3 but with a higher gap: k-firms set $\tau^B = (0.0001; 0.001; 0.01)$, whilst c-firms set $\tau^B = (0.0005; 0.005; 0.05)$. Experiments are summarized in Table 2.2, while the significance of the experiments Table 8 in Appendix G.7:

Table 2.2: **Experiments**. Liquidity fraction parameter's values according to the different experiments.

	Liquidity fraction
Experiment 1	$\tau^B = \{0.0001; 0.001; 0.01\}$.
Experiment 2	$\tau^B = \{0.0005; 0.005; 0.05\}$.
Experiment 3	$\tau^B = \{(0.0001, 0.00025); (0.001, 0.0025); (0.01, 0.025)\}$
Experiment 4	$\tau^B = \{(0.0001, 0.0005); (0.001, 0.005); (0.01, 0.05)\}$

When Firms Buy corporate Bonds: Experiments' Outcomes

The first experiment consists of setting three different low liquidity fraction values and run 15 Monte Carlo simulations for each low value of τ^B: the light blue trends in the top panels of Figure2.3 averages out the Monte Carlo simulations for $\tau^B = 0.0001$; the blue trends for $\tau^B = 0.001$ and the dark blue ones for $\tau^B = 0.01$. Right after, we consider the case in which a higher set of liquidity fraction is employed in the decision process (Experiment 2) and we can observe the averages of 15 Monte Carlo simulations in the bottom panels of Figure2.3: the light green trends are the outcome of $\tau^B = 0.0005$; the green line of $\tau^B = 0.005$ and the dark green one of $\tau^B = 0.05$. An important assumption of these two first experiments is that all firms in all sectors use the same liquidity fraction. Experiment 1 suggests that firms' engagement in the lending activity through bonds' purchasing is detrimental to growth (top left panel): in all cases, indeed, GDP grows much less than in the baseline scenario (where credit consists of bank loans only).

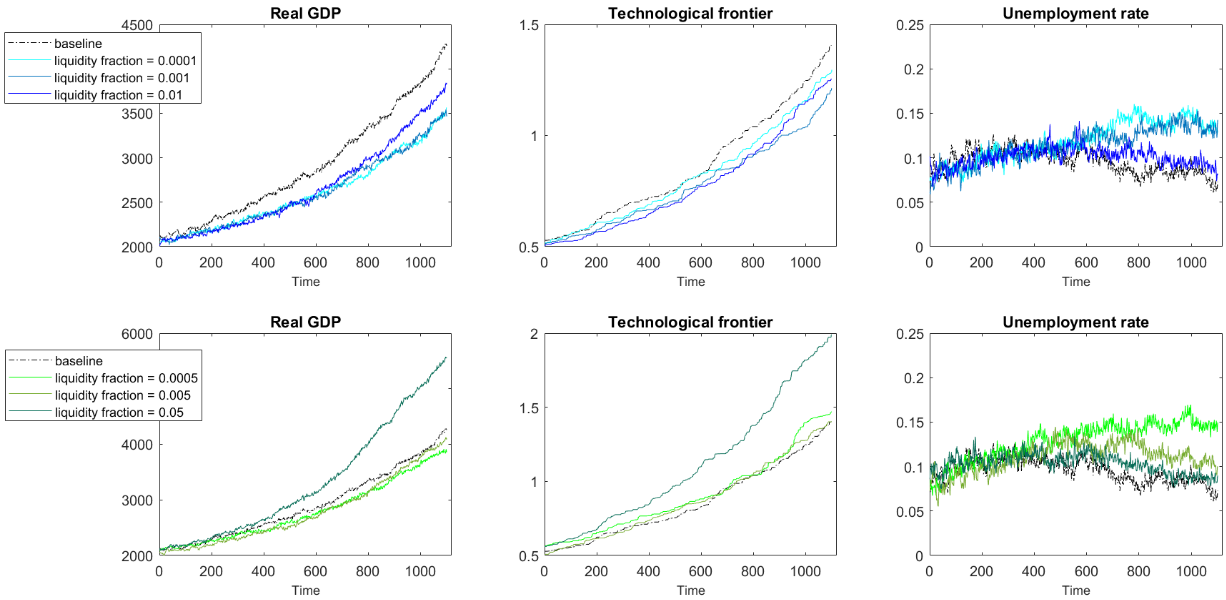


Figure 2.3: **GDP, technological frontier of the economy and unemployment rate when all firms set the same fraction τ^B = (0.0001, 0.001, 0.01), top panels, and then increase the fraction τ^B = (0.0005, 0.005, 0.05), bottom panel.**

The left bottom panel, however, tells another story: it seems that as long as the fraction of liquidity remains below a certain threshold, the negative impact on growth persists; as the threshold is overcome, instead, the result is strongly reversed and corporations' financial portfolios foster economic growth and technological progress. This overall picture might be explained through the finance-growth nexus, attributing the positive effect on growth to the higher availability of credit. If all companies, indeed, set their liquidity quota according to a very small fraction, there might be a credit contraction due to the fact that, by model construction, firms ask for credit bank only to cover the 50-65% of their financing gap, so there might be credit rationing due to insufficient disposable money on financial markets. As corporations decide to increase their liquidity quota to be dedicated to financial assets, the credit expansion will fuel R&D, investment and therefore technological progress. Higher credit availability, indeed, stimulates capital investment, rising demand for intangibles and increasing R&D efforts of k-firms, which from the one hand can take advantage of increased profits due to financial profits, and on the other, will increase their indebtedness if necessary. Technological frontier, indeed, moves faster in any simulation of experiment 2, together with c-firms' profitability, wages and aggregate demand which stimulates further production of the consumption good and intangibles' demand/investment. K-innovator, cannot relax and enjoy the appropriability effect as in the baseline model because the economy is less stagnant, demand for intagibles is higher and this pushes k-firms to try and escape competition, also thanks to the additional profits coming from financial markets, which increase the quota of profits to be invested in R&D.

The impressive increase of GDP and the technological frontier, however, has some drawbacks. Figure2.4, indeed, shows that the bankruptcy rate increases up to 2% when it comes to

$\tau^B = 0.05$ (it is the only case: as we can observe in Appendix H.8, that reports bankruptcy rates for all experiments) together with the share of Ponzi units in the economy (whilst both the hedge share and the speculative share converge to the baseline scenario), signalling that excessive amounts of liquidity fractions going to bonds may generate some financial instability. The mechanism is once again endogenous: the increased external financing availability, which pushes innovation and growth, also pushes high demand because of increasing wages (see Figure13 in the Appendix) and, therefore, desired production of firms. This causes a rush to bank loans and further bonds' issuance (since they might have used some liquidity to hold c-bonds and) and a decrease in profitability, due to higher costs of debt. Firms' liquidity begins to suffer but we do not observe any significant shift toward more speculative positions in the economy that leads to a jump in unpaid interests to banks -which will be less prone to concede credit and increase interest rates- and debt renegotiations. The only interesting consequence refers to increased leverage and interests payments that bring a certain number of firms to a Ponzi position and to default.

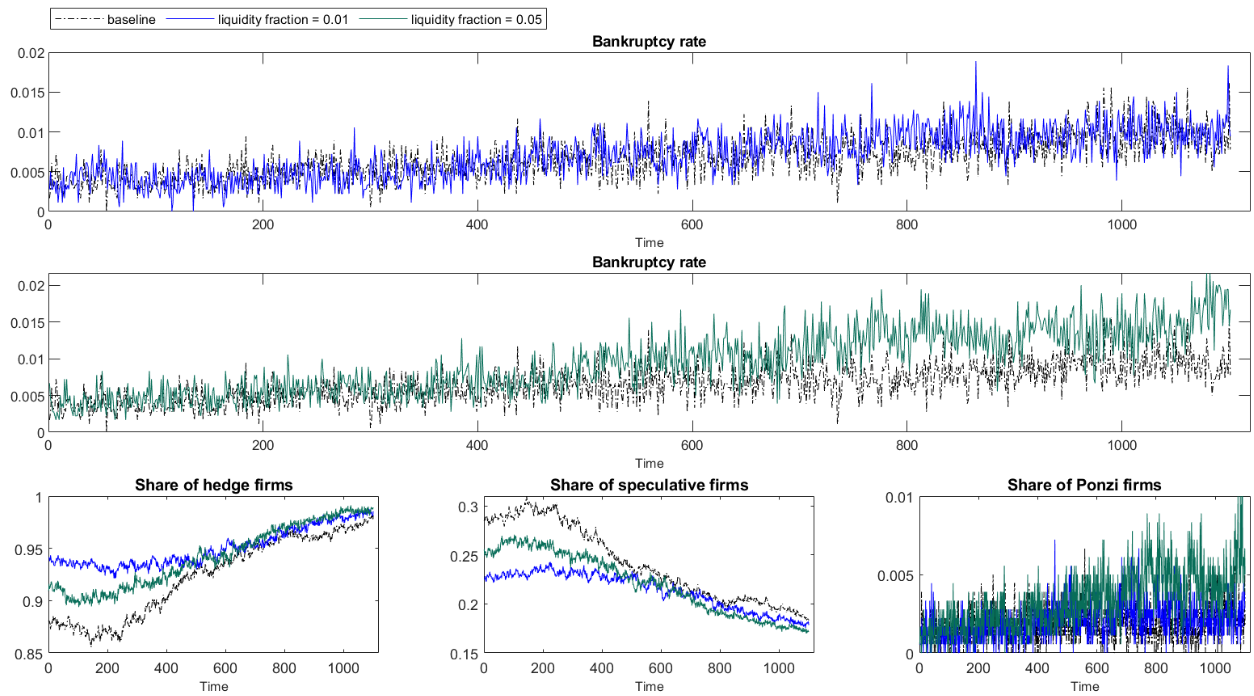


Figure 2.4: **Bankruptcy rate and and composition of the economy according to financial fragility for $\tau^B = 0.01$ (blue trends) and for $\tau^B = 0.05$ (red trends)**

Let us finally consider Experiment 3 and 4. The crucial difference with respect to the two previous experiments, is that companies invest different fractions of liquidity into bonds. to simplify things to the maximum extent, we assumed that all firms belonging to the same sector set the same liquidity fraction τ^B, but this fraction must be different among the two sectors. Suppose then that k-firms set $\tau^B = \{0.0001; 0.001; 0.01\}$, whilst c-firms set $\tau^B = \{0.00025; 0.0025; 0.025\}$ (Experiment 3) in a first moment and then that c-firms further increase their $\tau^B = \{0.0005; 0.005; 0.05\}$ (Experiment 4). The main trends stemming from the averaging out of the 15 Monte Carlo simulations are reported in Figure 2.5.

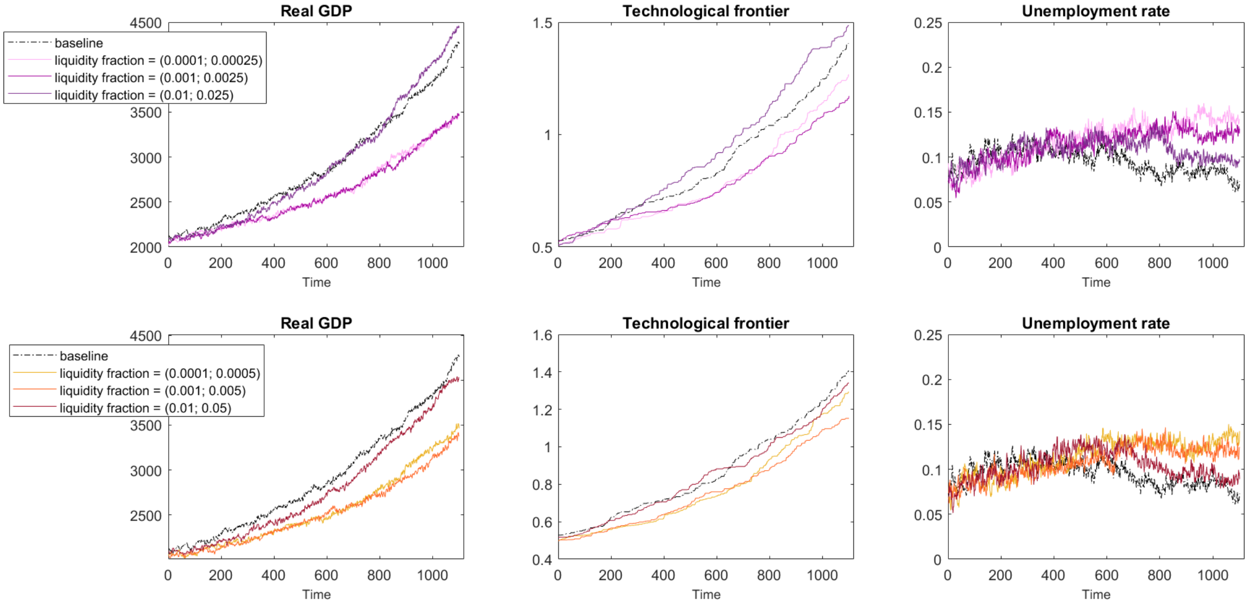


Figure 2.5: **GDP, technological frontier of the economy and unemployment rate when k-firms set a fraction τ^B = (0.0001, 0.001, 0.01), top panels, and c-firms set a higher fraction τ^B = (0.0005, 0.005, 0.05), bottom panel.**

In both experiments, we do not observe dramatic departures from the baseline scenario, as in the second experiment simulation with $\tau^B = 0.05$. Rather, the introduction of an element of heterogeneity among firms in financial investment decisions does not seem to foster technical change –with only one exception. Furthermore, the situation even worsens if we significantly increase this gap: in the bottom left panel of Figure2.5 we can observe, indeed, that GDP never overperforms the baseline model, whilst it did when the gap was smaller (top left panel, dark purple time series). Although this result is far from being conclusive and needs further investigation, it is worth trying to figure out what might be the possible mechanisms behind. Why should heterogeneous behaviour in corporations' financial investment decisions – including corporate risky bonds – decelerate growth? Partly because there is again some a priori credit rationing mechanism, at least with respect to the experiment 2 case (where the mismatch has been very low from the very beginning). k-firms invest a lower quota of their liquidity in c-firms' bonds and the amount provided by k-firms might not be enough. However, there is no such difference in credit mismatch between the baseline scenario and the experiment 4 scenario that can that can fully justify the negative impact on growth. Another part of the story, may be explained by the emergence of a trade-off mechanism between financial investment and c-firms' investment: by non homogenously increasing the fraction of liquidity going to bonds in the economy, and specifically, augmenting the c-firms' quotas, c-firms will have less available deposits for intangibles' investments; c-firms' demand for intangibles will decrease and so does desired production – and therefore production – of k-firms. It follows that less profits for k-firms translate into lower engagement in R&D (and thus less technological progress and lower growth). Summing up, although at the beginning k-firms will benefit from higher available credit thanks to higher liquidity quotas of c-firms, the trade-off effect eventually leads to lower innovation.

A final comment concerns employment: in the vast majority of experiments' simulations the unemployment rate is substantially higher – reaching the 15% in some cases, and however above the 10% – with respect to that of the baseline scenario. This is particularly true for very low levels of τ^B. It is not surprising in light of the previous considerations: when k-firms stop performing or perform lower R&D, they fire workers unless they increase production. But if intangibles demand is low, desired production will be low as well. Lower innovation also translates into lower wages (as shown in Figure13 in the Appendix), which further depress aggregate demand and desired production of c-firms. In any of the experiment, however, despite the negative impact that the purchase of bonds have on wages and unemployment, the latter never follows an explosive path, stabilizing itself around a trend. Finally, in this model inequality does not worsens significantly throughout the various experiments, despite a higher financialization of the economy. This might seem at odds with the literature on financialization, but the present model is too simple from the point of view of shareholders' heterogeneity and cannot capture all related aspects. Inequality here can increase only if firms succeed in making huge financial profits, thus increasing capitalists' income: the Gini index slighlty increases in the experiments involving higher levels of τ^B; nevertheless, the change is quite unnoticeable and this is perhaps due to the fact that financial profits cannot compensate for "profit losses" due to low demand and stagnant growth.

Discussion on Liquidity

Some single simulations has been extrapolated and are here presented in order to visualize the effects of innovation on firms' liquidity. The endogenous Schumpeterian mechanism driving R&D efforts and, consequently, learning and the innovation process is expected to favour the accumulation of innovators' deposits, as shown in Figure2.6:

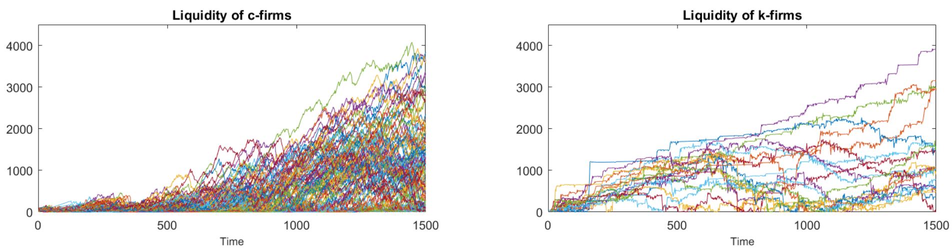


Figure 2.6: **Liquidity of firms, baseline model.** Firms' liquidity in c-sector (left) and k-sector (right), single simulation of the baseline model.

In both sectors, some firms succeed in accumulating very high levels of liquidity. Consider for instance the green curve in the c-sector continuously above the others from about t=800 on: it became the most innovative consumption-good producer between t = 625-687, and even though another c-firm takes over around t = 700, intangibles' properties, by lowering unit labor costs and expanding the platform of potential buyers, ensures it the highest levels of liquidity for a long time before the decline. In the k-sector, instead, the purple top line corresponds exactly to the last innovator. It has the biggest share of the market – which explains those levels of liquidity – and a price below the average price, but extremely low unit labor costs which allow it to set the highest mark-up among k-firms (0.0717; the second highest mark-up is 0.0595). The imitator, however, is right behind (orange line) and already cought up, having reached the frontier: it gained a similar fraction of market share and charged a similar price. Its R&D effort almost equals the one of the last innovator, which is trying to engage in drastic R&D to escape competition. The high learning parameter of the follower, and its high liquidity and their neck-and-neckness do not leave room for the appropriability effect to the last innovator. However, its mark-up is of 0.0107 only, confirming that the model is able to generate monopoly rents for firms that succeed in innovating.

What happens when bonds are introduced? Let us consider only a selection of τ^B parameter's values to fix the main points.

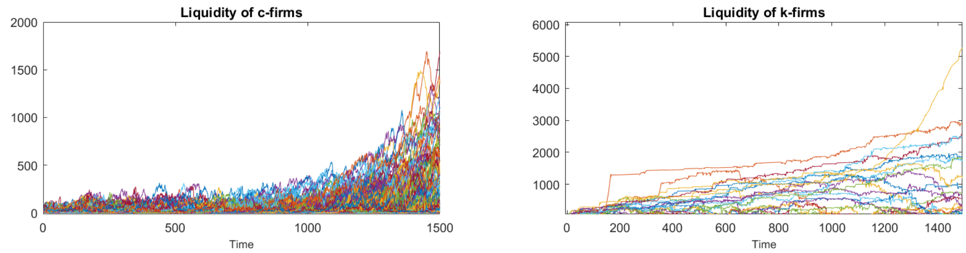


Figure 2.7: **Liquidity of firms, Experiment 1, with τ^B = 0.001.** Firms' liquidity in c-sector (left) and k-sector (right), single simulation of the baseline model.

Two observations jump to the eye: first, firms in the k-sector can accumulate higher deposits with respect to those operating in the c-sector and second, c-firms take a very long time to begin accumulating significant liquidity. This is in line with the rationing mechanism arising with low levels of financial investment quotas to be invested in bonds. In the k-sector instead k-innovator remains the same for the entire period (yellow line) but succeeded in becoming the mostly highly liquid firm only after t=1300. This time the innovator charges a price well above the mean and has a low market share. However, given the extremely high mark-ups (1.6700) and financial profits, it can continue sustaining high levels of liquidity. The R&D effort of the last innovator is not the highest one and also the learning parameter is not particularly relevant with respect to incumbents, however, it will still have higher probabilities of accessing innovation simply because of its high profits, also supported by high quantities of corporate bonds in its portfolio.

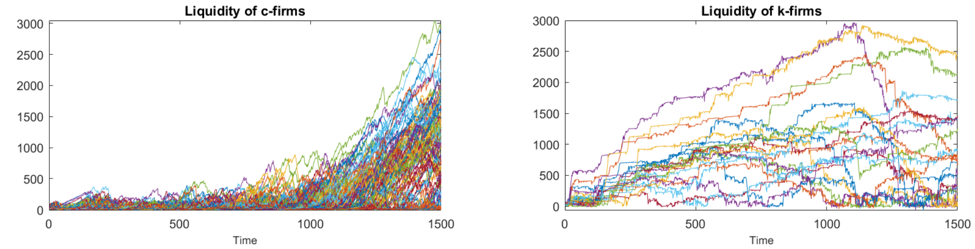


Figure 2.8: **Liquidity of firms, Experiment 2, with $\tau^B = 0.005$.** Firms' liquidity in c-sector (left) and k-sector (right), single simulation of the baseline model.

Once again the effects of being the c-firm with the greatest intangibles are long-lasting. The green line corresponds to the c-innovator from period t = 794 to t = 856, which charges a price around the mean and has no abnormal financial investment. The same is true for the k-sector: last innovator does not correspond to the one with the greatest liquidity, which is instead the previous innovator (yellow curve): despite a new innovation occurred in t = 1256, the previous innovator remains the most rich k-firm also thanks to its great amount of financial assets. It actually put in place a significative amount of R&D effort in the end, however, its learning parameter is around the mean signalling that it has not innovated a lot in the previous period. This has improbably happened because it did not have access to the innovation process (high profits imply higher probability of accessing innovation), but rather because of previous low R&D effort.

Overall innovation can increase liquidity and even create some concentration of liquidity for periods of time. If this is evident in the baseline scenario, it is less evident in the selected two experiments. In the c-sector, the accumulation of innovative intangible capital, can enhance c-firms' liquidity, also for many periods after a new c-firm takes over with more innovative capital and this situations remains almost unchanged when corporate bonds enter the model. In the k-sector, instead, things are different: innovation can increase liquidity through higher sales (due to higher probabilities of being visited) but when firms start purchasing bonds, liquidity is increased also through financial profits, which in some cases sustain high levels of liquidity even though the firm is no more on the frontier, while in the baseline scenario it appears that k-firms employ some more efforts to keep escaping competition. The introduction of bonds, shifts more towards an appropriability effect, which not always leads to success but that can however sustain some periods of concentrated liquidity.

2.5 Conclusions

The model stemming from this chapter is an attempt to formalize in a unique agent-based setting, innovation and financial frictions when firms behave as credit suppliers. The two main novelties that this model introduces are related to (i) the creation of a variable for capital that includes both physical capital (treated as an endowment) and intangible capital (mainly representing the IT sector, i.e. artificial intelligence, softwares, big data etc – so that specific advertising properties can be attached); and (ii) the purchase of corporate bonds by other corporations with excess liquidity. This credit channel has been poorly investigated but deserves some attention since it is an increasing financialization phenomenon. The complexity of the model forced to make very restrictive assumptions, such as the absence of a secondary market that makes firms that invest in corporate bonds holding them until maturity (it follows that capital gains are excluded from the analysis) and the lack of an endogenous mechanism determining companies' liquidity fraction to be allocated to bonds. Different experiments are therefore presented using different exogenous parameters: in almost all experiments but one, corporations' bonds acquisitions hamper growth – mostly because of excessive initial credit rationing and for lower funds available to carry investments –, increasing the unemployment rate and dampening technological progress. However, this conclusion seems to hold until a certain threshold, whereupon the additional credit availability stimulates the economy, raising wages, aggregate consumption, production and investment as well as R&D, which accelerates the pace of innovation. Higher access to credit, however, and the interrelated balance sheets of firms also increases the bankruptcy rate. Finally, when the bonds' channel opens, the rules of the game about firms' liquidity appear to somehow change, so that we can easily observe corporations no more at the frontier which are however able to continue experiencing long periods of liquidity concentration.

Overall Conclusions

The current dissertation tried to address two main phenomena shaping our economy: (i) the digitalization of the economy, mainly proxied by R&D and intangibles and (ii) financialization, with particular attention to corporations' financial investments. A special focus on their relationship with market power follows the entire analysis. The first chapter provides an empirical investigation of the determinants of corporations' Surplus Wealth and their capital investment decisions. Overall, Surplus Wealth is affected by financialization and, in particular, by shareholders' value orientation, that almost doubles its effect on monopoly Surplus Wealth. Financial investment, instead appear to be beneficial to both tangible capital investment and intangible capital investment for the overall economy; however, current financial investment actually seem to cause a trade-off effect with capital investment decision making. These features do not stem from GMM regressions on monopolists operating in the IT sector, which instead are not affected at all by financial investment concerning physical capital expenditure, whilst R&D and advertising expenditure appears to be positively affected by financial profits, current financial assets and past financial investment. The second chapter develops, instead, a theoretical agent-based model that brings together two models of the macro ABMs tradition: the CATS model – that focuses on financial frictions – and the K+S model – which unfolds endogenous growth in a Schumpeterian framework. Intangible capital is introduced in the production function and is assumed to be the channel through which innovation, pursued by means of R&D, propagates. Specific advertising properties of intangibles are able to generate accumulation of liquidity, which can even last more when financial investments begin to play a role. From a macroeconomic perspective, companies' purchase of corporate bonds is not beneficial to growth, except when the liquidity fraction parameter overcomes a given threshold: below, there is a credit rationing mechanism due to excess demand for credit; above the finance-growth nexus operates – fostering technological progress – but at the expense of higher bankruptcies. Further, when we introduce some heterogeneity concerning firms' liquidity parameter to be devolved to financial assets, the economy performs worse with respect to the baseline scenario (without market for bonds), due to the emergence of the trade-off effect between capital investment and financial investment. The present analysis is far from being conclusive: the empirical study could be further improved and the theoretical model needs some more realistic extensions, such as corporate bonds' trading and an endogenous decision process to determine how much a firm wants to invest in financial assets. Nevertheless, it can provide some insights on two emergent phenomena that perhaps need some attention.

Appendices

A.1 - Summary Statistics

Table 3: **Summary statistics**

	Representative sample			Q2 sample			P95 sample		
Variable	**Mean**	**Std.Dev.**	**Obs.**	**Mean**	**Std.Dev.**	**Obs.**	**Mean**	**Std.Dev.**	**Obs.**
SW	369.95	ov: 1576.690 btw: 895.701 wth: 1262.109	N=57203 n=2275 T-bar=25.34	3118.286	ov: 17791.620 btw: 7851.728 wth: 13465	N=73431 n=6440 T-bar= 11.40	23672.86	ov: 51628.040 btw: 21989.420 wth: 40567	N=7325 n= 857 T-bar=8.55
$SALES$	917.10	ov: 2067.086 btw: 1389.953 wth: 1364.885	N=57203 n=2257 T-bar=25.34	3399.650	ov: 15544.160 btw: 9932.552 wth: 8806.927	N=73431 n=6440 T-bar= 11.402	19731.64	ov: 41561.16 btw: 25350.980 wth: 24562.360	N=7325 857 T-bar=8.55
LEV	0.514	ov: 0.557 btw: 0.266 wth: 0.501	N=57202 n=2257 T-bar=25.34	0.633	ov: 15.577 btw: 15.444 wth: 12.458	N=73431 n=6440 T-bar=11.40	0.529	ov: 0.230 btw: 0.258 wth: 0.127	N=7325 n= 857 T-bar=8.547
$TobinQ$	1.774	ov: 1.955 btw: 1.207 wth: 1.604	N=57202 n=2257 T-bar=25.34	2.858	ov: 19.656 btw: 35.150 wth: 13.483	N= 73431 n=6440 T-bar=11.40	3.062	ov: 4.260 btw: 5.461 wth: 3.397	N=7325 n=857 T-bar=8.55
$Lprod$	0.003	ov: 0.005 btw: 0.003 wth: 0.003	N=55769 n=2256 T-bar=24.72	0.004	ov: 0.021 btw: 0.031 wth: 0.015	N=71054 n= 6348 T-bar=11.19	0.006	ov: 0.038 btw: 0.022 wth: 0.032	N=7135 n= 836 T-bar=8.53
DIV	13.032	ov: 50.147 btw: 23.989 wth: 42.496	N=57203 n= 2257 T-bar=25.34	90.694	ov: 528.239 ov: 295.629 wth: 353.011	N=73431 n=6440 T-bar=11.40	666.942	ov: 1495.453 btw: 782.683 wth: 1065.023	N=7325 n= 857 T-bar=8.55
$BUYBACK$	17.651	ov: 91.214 btw: 34.498 wth: 83.098	N=57203 n=2257 T-bar=25.34	98.168	ov: 758.699 btw: 297.388 wth; 649.316	N= 73431 n=6440 T-bar=11.40	669.798	ov: 2297.529 btw: 843.999 wth: 1958.553	N=7325 n= 857 T-bar=8.55
$MKT\ FINANCE$	88.927	ov: 372.628 btw: 163.507 wth: 332.296	N=57203 n=2257 T-bar=25.34	321.101	ov: 1977.326 btw: 1592.801 wth: 1384.409	N=73431 n=6440 T-bar= 11.40	1478.238	ov: 4709.921 btw: 3878.42 wth: 3324.28	N=7325 n=857 T-bar=8.55
π^{fin}	2.271	ov: 7.790 btw: 4.723 wth: 6.048	N=57203 n=2257 T-bar=25.34	9.899	ov: 64.668 btw: 44.743 wth: 42.278	N=73431 n= 6440 T-bar=11.40	66.752	ov: 182.916 btw: 124.152 wth: 118.722	N=7325 n=857 T-bar=8.55
I^{κ}	43.672	ov: 112.573 btw: 75.881 wth: 78.924	N=57203 n=2257 T-bar=25.34	209.917	ov: 1178.485 btw: 832.888 wth: 683.845	N=73416 n=6440 T-bar= 11.40	1263.051	ov: 3220.162 btw: 2144.254 wth: 1926.458	N=7322 n=857 T-bar=8.54
I^{intan}	28.184	ov: 82.636 btw: 57.699 wth: 55.561	N=57203 n= 2257 T-bar=25.34	145.901	ov: 788.480 btw: 432.219 wth: 493.202	N=73416 n= 6440 T-bar=11.40	1015.200	ov: 2180.309 btw: 1100.030 wth = 1486.84	N=7322 n=857 T-bar= 8.54
$DEBT$	194.78	ov: 581.457 btw: 330.943 wth: 454.646	N=57167 n=2257 T-bar=25.33	744.521	ov: 3381.307 btw: 2208.973 wth: 2122.225	N=73368 n=6440 T-bar=11.39	3918.433	ov: 8530.568 btw: 5330.001 wth: 5791.962	N=7314 n=857 T-bar=8.53
PAY^{fin}	47.045	ov: 136.843 btw: 68.471 wth: 113.630	N=57203 n=2257 T-bar=25.34	237.152	ov: 1240.498 btw: 613.284 wth: 915.741	N= 73416 n=6440 T-bar=11.40	1581.734	ov: 3531.024 btw: 1606.581 wth: 2757.553	N=7322 n=857 T-bar=8.54
RED	49.504	ov: 177.832 btw: 96.468 wth: 143.838	N=57203 n=2257 T-bar=25.34	481.775	ov: 4248.884 btw: 2183.848 wth: 2949.057	N=73416 n=6440 T-bar=11.40	3574.21	ov: 12575.400 btw: 5920.382 wth: 8861.973	N= 7322 n=857 T-bar=8.54
$s.t.\ I^{fin}$	18.551	ov: 69.853 btw: 40.439 wth: 57.834	N=57203 n=2257 T-bar=25.34	156.242	ov: 1649.065 btw: 791.508 wth: 1212.242	N=73416 n=6440 T-bar=11.40	1130.105	ov: 5028.975 btw: 2304.784 wth: 3712.95	N=7322 n=857 T-bar=8.54

Variables are already adjusted for missing values. Variables used in the Surplus Wealth analysis are then standardized (variables are reported with an "s" at the beginning). Variables used in the investment analysis are then deflated by GDP price index 2015 base year -source FRED- (except for capx which is deflated by Investment goods price index), further adjusted by total assets to correct for heteroskedasticity and turned into logs (variables are reported in lower case letters).

B.2 - Period Subsamples Analysis

Table 4: **Fixed-effect regression of Surplus Wealth on sales, leverage, Tobin's q, labor productivity, acquisitions, intangibles' proxy, dividends paid, buybacks, newly issued stocks and bonds and financial profits.All variables but dummies standardized. Representative sample: Period subsample 1970-1985 (left); period subsample 1986-2001 (center); period subsample 2002-2018 (right).**

Representative sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t
$sSALES_t$	-0.458***	-0.527***	-0.459***	-0.452***	-0.455***	-0.453***	-0.436***	-0.481***
	(0.0778)	(0.0893)	(0.0781)	(0.0995)	(0.0759)	(0.0801)	(0.0995)	(0.104)
$sLEV_t$	-0.0313***	-0.0316***	-0.0313***	-0.0353***	-0.0310***	-0.0314***	-0.0338***	-0.0351***
	(0.00896)	(0.00884)	(0.00901)	(0.00971)	(0.00843)	(0.00898)	(0.00905)	(0.00919)
$sTobinQ_t$	0.202***	0.206***	0.202***	0.201***	0.202***	0.202***	0.201***	0.204***
	(0.0229)	(0.0233)	(0.0229)	(0.0226)	(0.0229)	(0.0228)	(0.0226)	(0.0230)
$sLprod_t$	0.0227	0.0221	0.0229	0.0226	0.0226	0.0226	0.0220	0.0195
	(0.0220)	(0.0217)	(0.0220)	(0.0219)	(0.0220)	(0.0221)	(0.0220)	(0.0217)
sI_t^{intan}		0.0985						0.111
		(0.0699)						(0.0747)
ACQ_t			0.0162				0.0253	0.0298
			(0.0196)				(0.0212)	(0.0202)
$sDIV_t$				-0.0392			-0.0384	-0.0725
				(0.101)			(0.0992)	(0.102)
$sBUYBACK_t$				0.0730***			0.0802***	0.0768***
				(0.0184)			(0.0188)	(0.0193)
$sMKT\ FINANCE_t$					-0.00495		-0.0319	-0.0316
					(0.0322)		(0.0329)	(0.0315)
$s\pi_t^{fin}$						-0.00780	-0.00619	-0.0192
						(0.0424)	(0.0399)	(0.0410)
N. obs.	16958	16958	16958	16958	16958	16958	16958	16958
N. firms	1390	1390	1390	1390	1390	1390	1390	1390
R^2 *within*	0.203	0.207	0.203	0.214	0.203	0.203	0.215	0.220
R^2 *between*	0.368	0.402	0.369	0.370	0.369	0.367	0.376	0.405
R^2*overall*	0.341	0.364	0.341	0.345	0.341	0.340	0.351	0.371
Time fixed eff.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t
$sSALES_t$	0.358***	0.198**	0.358***	0.329***	0.346***	0.332***	0.300***	0.155*
	(0.103)	(0.0992)	(0.103)	(0.100)	(0.100)	(0.0961)	(0.0923)	(0.0920)
$sLEV_t$	-0.0284	-0.0302	-0.0283	-0.0292	-0.0290	-0.0275	-0.0287	-0.0303
	(0.0365)	(0.0358)	(0.0365)	(0.0359)	(0.0363)	(0.0367)	(0.0361)	(0.0355)
$sTobinQ_t$	0.222***	0.223***	0.222***	0.220***	0.222***	0.222***	0.220***	0.221***
	(0.0350)	(0.0349)	(0.0350)	(0.0346)	(0.0350)	(0.0349)	(0.0345)	(0.0345)
$sLprod_t$	0.0198*	0.0154*	0.0199**	0.0203**	0.0200**	0.0186*	0.0194**	0.0149*
	(0.0101)	(0.00828)	(0.0100)	(0.0101)	(0.0102)	(0.00970)	(0.00964)	(0.00792)
sI_t^{intan}		0.369***						0.358***
		(0.107)						(0.105)
ACQ_t			0.00484				-0.00195	-0.00904
			(0.0196)				(0.0198)	(0.0200)
$sDIV_t$				0.0161			0.0117	0.00716
				(0.0287)			(0.0286)	(0.0252)
$sBUYBACK_t$				0.0987***			0.0920***	0.0903***
				(0.0210)			(0.0211)	(0.0210)
$sMKT\ FINANCE_t$					0.0250		0.0171	0.00712
					(0.0238)		(0.0237)	(0.0183)
$s\pi_t^{fin}$						0.114***	0.103**	0.0886**
						(0.0395)	(0.0401)	(0.0367)
N. obs.	21509	21509	21509	21509	21509	21509	21509	21509
N. firms	2005	2005	2005	2005	2005	2005	2005	2005
R^2 *within*	0.136	0.183	0.136	0.150	0.137	0.145	0.157	0.201
R^2 *between*	0.182	0.264	0.183	0.220	0.184	0.201	0.232	0.283
R^2*overall*	0.159	0.258	0.160	0.192	0.161	0.179	0.206	0.285
Time fixed eff.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t	sSW_t
$sSALES_t$	0.402***	0.284***	0.402***	0.249***	0.387***	0.390***	0.240**	0.159*
	(0.109)	(0.108)	(0.109)	(0.0930)	(0.109)	(0.109)	(0.0938)	(0.0965)
$sLEV_t$	-0.0783***	-0.0809***	-0.0781***	-0.0733***	-0.0796***	-0.0782***	-0.0735***	-0.0752***
	(0.0172)	(0.0175)	(0.0172)	(0.0160)	(0.0173)	(0.0172)	(0.0161)	(0.0164)
$sTobinQ_t$	0.183***	0.187***	0.183***	0.170***	0.184***	0.183***	0.170***	0.174***
	(0.0357)	(0.0365)	(0.0357)	(0.0332)	(0.0359)	(0.0357)	(0.0334)	(0.0340)
$sLprod_t$	-0.0103**	-0.0104***	-0.0102**	-0.0112**	-0.0100**	-0.0104**	-0.0111**	-0.0112***
	(0.00410)	(0.00377)	(0.00414)	(0.00454)	(0.00416)	(0.00412)	(0.00458)	(0.00426)
sI_t^{intan}		0.234**						0.190**
		(0.0911)						(0.0870)
ACQ_t			0.0169				0.0148	0.0105
			(0.0167)				(0.0155)	(0.0151)
$sDIV_t$				0.215***			0.213***	0.202***
				(0.0461)			(0.0456)	(0.0426)
$sBUYBACK_t$				0.112***			0.109***	0.107***
				(0.0255)			(0.0259)	(0.0248)
$sMKT\ FINANCE_t$					0.0313		0.00584	-0.0104
					(0.0221)		(0.0226)	(0.0254)
$s\pi_t^{fin}$						0.0471*	0.0265	0.0242
						(0.0266)	(0.0228)	(0.0227)
N. obs.	17301	17301	17301	17301	17301	17301	17301	17301
N. firms	1467	1467	1467	1467	1467	1467	1467	1467
R^2 *within*	0.169	0.191	0.169	0.239	0.170	0.171	0.240	0.254
R^2 *between*	0.214	0.377	0.215	0.439	0.219	0.232	0.449	0.551
R^2*overall*	0.211	0.317	0.212	0.391	0.216	0.221	0.396	0.456
Time fixed eff.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* p<.1, ** p<.05, *** p<.01

Table 5: **Dynamic GMM in orthogonal deviations regression of capital investment on past capital investment, sales, long-term debt, financial payments, acquisition dummy, financial profits and current and lagged financial investment (total and short-term). Representative sample: period subsample 1970-1985 (left); period subsample 1986-2001 (center); period subsample 2002-2018 (right).**

	Representative sample														
	1970-1985					**1986-2001**					**2002-2018**				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ	i_t^κ
i_{t-1}^κ	0.403***	0.358***	0.337***	0.338***	0.482***	0.188*	0.259***	0.397***	0.234**	0.447***	0.435***	0.323***	0.261	0.319***	0.352*
	(0.0618)	(0.0550)	(0.0688)	(0.0556)	(0.0794)	(0.0996)	(0.0957)	(0.143)	(0.104)	(0.173)	(0.105)	(0.108)	(0.179)	(0.119)	(0.184)
$sales_{t-1}$	0.369***	0.437***	0.523***	0.514***	0.532***	0.337***	0.246***	0.328***	0.311***	0.221***	0.288***	0.258***	0.275***	0.299***	0.273***
	(0.0930)	(0.0654)	(0.0689)	(0.0697)	(0.0604)	(0.0571)	(0.0528)	(0.0685)	(0.0579)	(0.0811)	(0.0576)	(0.0559)	(0.0679)	(0.0547)	(0.0625)
$debt_{t-1}$	-0.0940***	-0.0874***	-0.0919***	-0.0694***	-0.0687***	-0.0159	-0.0199*	-0.0140	-0.00980	-0.0182	-0.0315***	-0.0355***	-0.0321***	-0.0312***	-0.0330***
	(0.0183)	(0.0138)	(0.0160)	(0.0131)	(0.0149)	(0.0114)	(0.0105)	(0.0121)	(0.0108)	(0.0129)	(0.00713)	(0.00714)	(0.00849)	(0.00730)	(0.00857)
pay_{t-1}^{fin}	-0.0439*	-0.0898***	-0.0965***	-0.0783***	-0.0546**	-0.0511***	-0.0362**	-0.0126	-0.0409***	-0.00158	0.00579	0.00272	0.00374	-0.00623	-0.00244
	(0.0249)	(0.0207)	(0.0234)	(0.0207)	(0.0245)	(0.0160)	(0.0166)	(0.0184)	(0.0156)	(0.0201)	(0.0122)	(0.0106)	(0.0124)	(0.0109)	(0.0128)
ACQ_{t-1}	0.0469**	0.0272	0.0242	0.0385**	0.0372**	0.0470**	0.0192	0.0415	0.0464*	0.0317	0.00525	0.0222	0.0346	0.0279	0.0153
	(0.0216)	(0.0174)	(0.0191)	(0.0171)	(0.0187)	(0.0228)	(0.0243)	(0.0281)	(0.0250)	(0.0327)	(0.0232)	(0.0217)	(0.0315)	(0.0233)	(0.0339)
$ln\ \pi_{t-1}^{fin}$	0.0835***					0.0635***					0.0261***				
	(0.0120)					(0.0125)					(0.00964)				
red_t		-0.0319***					-0.0343***					-0.0223***			
		(0.00760)					(0.00988)					(0.00781)			
$s.t.\ i_t^{fin}$			-0.0387***					-0.00250					-0.0212**		
			(0.00805)					(0.00976)					(0.0105)		
red_{t-1}				0.0527***					0.0225**					0.00148	
				(0.00748)					(0.0106)					(0.00712)	
$s.t.\ i_t^{fin}$					0.0618***					0.0403***					0.0112
					(0.00795)					(0.00984)					(0.00849)
$N.\ obs.$	5292	9106	6155	9180	6197	7970	7781	3839	7898	3968	6788	6821	4063	6777	4003
$N.\ firms$	891	1119	963	1125	968	1213	1271	846	1310	934	958	998	774	1001	766
$AR(1)\ test: z_1$	-7.11	-7.92	-6.18	-7.72	-6.53	-3.93	-4.48	-3.66	-4.07	-3.21	-5.02	-3.98	-2.26	-3.69	-2.44
$Prob > z_1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.024	0.000	0.015
$AR(2)\ test: z_2$	-0.87	-2.52	-1.54	-2.38	-0.42	-2.27	-0.31	0.31	-0.76	0.10	0.22	0.49	0.29	0.23	0.45
$Prob > z_2$	0.386	0.012	0.123	0.017	0.677	0.023	0.756	0.759	0.446	0.917	0.825	0.625	0.774	0.818	0.653
$Sargan\ test: J_1$	18.30	45.53	28.49	38.93	16.89	15.72	25.03	23.29	28.80	18.79	30.31	56.55	39.67	56.78	56.17
$Prob > J_1$	0.075	0.000	0.003	0.000	0.111	0.204	0.015	0.025	0.004	0.094	0.004	0.000	0.000	0.000	0.000
$Hansen\ test: J_2$	15.11	22.21	12.45	18.25	7.83	13.77	20.70	12.99	21.02	12.68	14.32	19.24	17.84	20.53	20.41
$Prob > J_2$	0.178	0.023	0.330	0.076	0.729	0.316	0.055	0.370	0.050	0.392	0.352	0.116	0.164	0.083	0.086
$Time\ fixed\ eff.$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* p<.1, ** p<.05, *** p<.01

Table 6: **Dynamic GMM in orthogonal deviations regression of intangible investment on past intangible investment, sales, long-term debt, financial payments, acquisition dummy, financial profits and current and lagged financial investment (total and short-term). Representative sample: period subsample 1970-1985 (left); period subsample 1986-2001 (center); period subsample 2002-2018 (right).**

	Representative sample														
	1970-1985					1986-2001					2002-2018				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}	i_t^{intan}
i_{t-1}^{intan}	0.0801	0.188	-0.224	0.00974	0.113	0.267	0.490**	0.566	0.575***	0.792***	0.445***	0.220	0.0483	0.300	0.0824
	(0.404)	(0.262)	(0.298)	(0.310)	(0.262)	(0.396)	(0.231)	(0.445)	(0.201)	(0.238)	(0.134)	(0.224)	(0.233)	(0.198)	(0.285)
$sales_{t-1}$	0.288*	0.316***	0.614***	0.382***	0.429***	0.277***	0.152***	0.148*	0.168***	0.128**	0.135***	0.206***	0.215***	0.218***	0.201***
	(0.170)	(0.116)	(0.157)	(0.132)	(0.120)	(0.0834)	(0.0537)	(0.0830)	(0.0564)	(0.0508)	(0.0457)	(0.0573)	(0.0599)	(0.0512)	(0.0615)
$debt_{t-1}$	-0.0194	-0.0317***	-0.00684	-0.0274**	-0.000000660	-0.0191***	-0.0150**	-0.0162	-0.0156**	-0.0171*	-0.0159***	-0.0139**	-0.0256***	-0.0119**	-0.0245***
	(0.0176)	(0.0123)	(0.0171)	(0.0129)	(0.0146)	(0.00738)	(0.00726)	(0.0102)	(0.00773)	(0.00880)	(0.00516)	(0.00593)	(0.00795)	(0.00553)	(0.00877)
pay_{t-1}^{fin}	0.00119	-0.0202	-0.0595*	-0.0368	-0.0330	0.0200	0.0260**	0.0288	0.0220*	0.0362***	0.0217**	0.0188*	0.0125	0.0214**	0.0141
	(0.0246)	(0.0237)	(0.0318)	(0.0282)	(0.0253)	(0.0212)	(0.0128)	(0.0177)	(0.0113)	(0.0135)	(0.0101)	(0.0113)	(0.0131)	(0.0101)	(0.0136)
ACQ_{t-1}	-0.00608	-0.0100	0.0262	0.00139	0.0101	-0.0206	-0.0549**	-0.0551	-0.0627***	-0.0904***	-0.0364***	-0.0221	-0.0118	-0.0265	-0.00788
	(0.0349)	(0.0205)	(0.0195)	(0.0239)	(0.0213)	(0.0500)	(0.0263)	(0.0498)	(0.0242)	(0.0275)	(0.0141)	(0.0185)	(0.0214)	(0.0190)	(0.0241)
$ln\ \pi_{t-1}^{fin}$	0.00297					0.0393***					0.0228***				
	(0.0176)					(0.0119)					(0.00738)				
red_t		-0.0172**					-0.0237***					-0.00846			
		(0.00800)					(0.00913)					(0.00587)			
$s.t.\ i_t^{fin}$			-0.0265***					-0.00705					0.000793		
			(0.00897)					(0.0109)					(0.00724)		
red_{t-1}				0.000164					0.00795					0.00246	
				(0.00852)					(0.00992)					(0.00596)	
$s.t.\ i_{t-1}^{fin}$					-0.000507					0.0115					0.00944
					(0.00734)					(0.00761)					(0.00761)
$N.\ obs.$	4215	6916	4725	6979	4742	5987	5473	2861	5546	2947	5665	5561	3304	5532	3272
$N.\ firms$	759	979	814	984	814	971	1011	675	1053	749	840	861	668	864	663
$AR(1)\ test: z_1$	-0.54	-1.22	-0.10	-0.54	-0.95	-1.14	-2.40	-1.53	-2.77	-3.22	-3.49	-1.40	-0.71	-1.90	-0.67
$Prob > z_1$	0.586	0.223	0.921	0.587	0.340	0.255	0.016	0.126	0.006	0.001	0.000	0.161	0.478	0.057	0.505
$AR(2)\ test: z_2$	-0.40	0.48	-1.21	-0.31	0.18	0.26	0.91	0.88	1.18	1.31	1.39	-0.86	-1.60	-0.29	-1.20
$Prob > z_2$	0.690	0.634	0.228	0.756	0.856	0.799	0.362	0.377	0.239	0.190	0.164	0.391	0.109	0.768	0.229
$Sargan\ test: J_1$	8.83	34.89	12.31	26.18	8.24	12.99	9.38	19.72	15.14	16.36	16.75	16.87	18.42	17.41	16.49
$Prob > J_1$	0.638	0.000	0.341	0.006	0.692	0.370	0.670	0.073	0.234	0.175	0.211	0.205	0.142	0.181	0.224
$Hansen\ test: J_2$	5.82	21.74	11.35	14.64	8.26	14.04	7.87	16.41	11.02	8.32	17.34	10.78	10.13	10.39	12.07
$Prob > J_2$	0.885	0.026	0.415	0.199	0.690	0.298	0.795	0.173	0.527	0.760	0.184	0.629	0.683	0.662	0.522
$Time\ fixed\ eff.$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* p<.1, ** p<.05, *** p<.01

C.3 - Estimated Mark-Ups

In this section of the Appendix we try to apply the mark-up estimation procedure described De Loecker, Eeckhout, and Unger (2020b) with the original insights of Olley and Pakes (1992) to calculate firm level mark-ups and extend the analysis on Surplus Wealth. Following the above mentioned literature, the mark-up is calculated as the ratio of revenues ($SALES$) over the cost of good sold ($COGS$), multiplied by the estimated elasticity of output (Z):

$$MARKUP_{i,t} = Z_{i,t}\left(\frac{SALES_{i,t}}{COGS_{i,t}}\right) \tag{46}$$

In order to estimate $Z_{i,t}$, which is unobservable, we run a two-stage regression with bootstrapped standard errors (but with investment – and not intermediate inputs – as a proxy for productivity following the original intuition of Olley and Pakes (1992)). To be in line with the analysis, outliers belonging to the 1^{st} and 99^{th} percentile of the mark-up distribution have been dropped. Figure 9 plots the average estimated mark-up from 1970 to 2018. As one can notice, although the trend is increasing (at least until 2010), coherently with evidence provided by De Loecker, Eeckhout, and Unger (2020a), its volatility does not replicate the cited work[40] and for this reason the analysis including mark-ups has been handled in this section of the Appendix. Furthermore, the correlation between $markup_t$ and SW_t is irrelevant: 11.7%, which is puzzling if we refer to standard theory, since we expect the two to be highly correlated. The difference in estimated mark-ups can be due to three main features: (i) our estimate may be wrong because we used capital expenditure and intangible expenditure as a proxy for productivity (mainly following Olley and Pakes (1992) intuitions instead of intermediate inputs) and in estimating output elasticity; (ii) we tried to estimate output elasticity for each individual firm and not by sector; (iii) mark-ups alone are no more able to capture monopolistic power. However, as a work in progress exercise and assuming that our mark-up estimates are reliable, we consider mark-ups among the control variables (as the ability of firms to increase prices and/or decrease variable costs even though they do not have significantly high levels of market power) and run the same regressions as those in Section 1.5. Results are shown in Table 7. Results basically replicate those in Table 1.3 and the inclusion of our mark-up estimate slightly improves the R^2 between, being its coefficient highly significant and positive (ranging from 2.73% to 5.10%) in all specifications.

[40]See Figure 1 pag. 9, De Loecker, Eeckhout, and Unger (2020a).

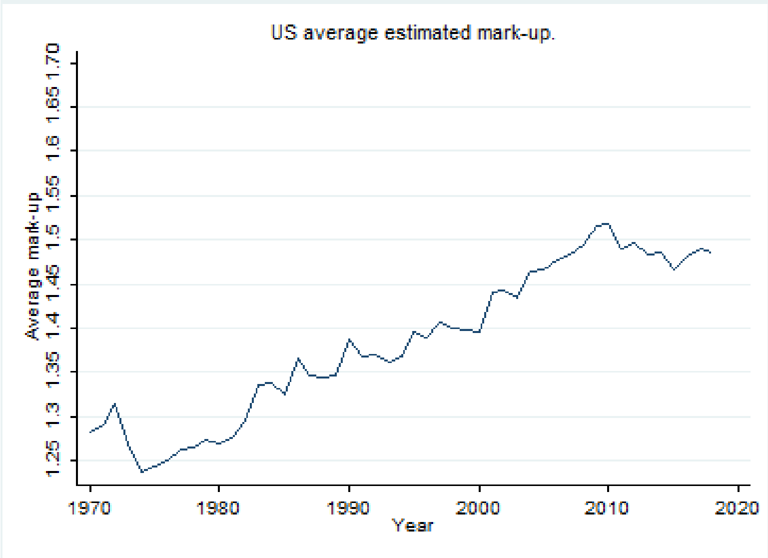


Figure 9: **Average estimated mark-up of US corporations. 1970-2018.**

Table 7: **Fixed-effect regression of Surplus Wealth on sales, leverage, Tobin's q, labor productivity, mark-up, acquisitions, intangibles' proxy, dividends paid, buybacks, newly issued stocks and bonds and financial profits. Period 1970-2018. Representative sample.**

	(1) sSW_t	(2) sSW_t	(3) sSW_t	(4) sSW_t	(5) sSW_t	(6) sSW_t	(7) sSW_t	(8) sSW_t
$sSALES_t$	0.348***	0.200***	0.347***	0.181***	0.327***	0.332***	0.169***	0.0818
	(0.0731)	(0.0686)	(0.0731)	(0.0592)	(0.0729)	(0.0729)	(0.0595)	(0.0580)
$sLEV_t$	-0.0309**	-0.0348***	-0.0306**	-0.0350***	-0.0335**	-0.0305**	-0.0350***	-0.0369***
	(0.0137)	(0.0133)	(0.0138)	(0.0122)	(0.0133)	(0.0139)	(0.0122)	(0.0122)
$sTobinQ_t$	0.181***	0.187***	0.181***	0.171***	0.182***	0.182***	0.172***	0.177***
	(0.0233)	(0.0242)	(0.0233)	(0.0221)	(0.0234)	(0.0234)	(0.0222)	(0.0230)
$sLprod_t$	-0.00107	-0.00479	-0.000558	0.000556	-0.000560	-0.00113	0.000976	-0.00236
	(0.00616)	(0.00469)	(0.00624)	(0.00586)	(0.00615)	(0.00614)	(0.00596)	(0.00449)
$sMARKUP_t$	0.0510***	0.0343***	0.0510***	0.0393***	0.0500***	0.0497***	0.0385***	0.0273***
	(0.0134)	(0.00951)	(0.0134)	(0.0113)	(0.0132)	(0.0131)	(0.0112)	(0.00862)
sI_t^{intan}		0.321***						0.251***
		(0.0635)						(0.0592)
$sACQ_t$			0.0350**				0.0244*	0.0170
			(0.0159)				(0.0132)	(0.0128)
$sDIV_t$				0.231***			0.228***	0.207***
				(0.0564)			(0.0560)	(0.0523)
$sBUYBACK_t$				0.174***			0.171***	0.158***
				(0.0322)			(0.0322)	(0.0301)
$sMKT\ FINANCE_t$					0.0568**		0.0133	-0.00919
					(0.0230)		(0.0221)	(0.0241)
$s\pi_t^{fin}$						0.0654***	0.0356	0.0122
						(0.0236)	(0.0218)	(0.0187)
N. obs.	54659	54659	54659	54659	54659	54659	54659	54659
N. firms	2203	2203	2203	2203	2203	2203	2203	2203
$R^2 within$	0.214	0.266	0.214	0.309	0.217	0.217	0.310	0.340
$R^2 between$	0.257	0.393	0.260	0.453	0.263	0.271	0.457	0.520
$R^2 overall$	0.229	0.316	0.230	0.374	0.234	0.236	0.376	0.417
$Time\ fixed\ eff.$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

D.4 Model Initialization

The model is initialized at the best possible scenario in the steady state (s.s. hereafter): (i) there is perfect competition in both consumption-good market and capital-good market;

(ii) the economy is characterized by full employment and (iii) firms can self-finance themselves with no need of external financing. The desired rate of unemployment at s.s., g_{Un}^{ss}, is set to be equal to zero; it follows that all workers are employed to produce the homogeneous consumption good and intangible capital. GDP is easily calculated by multiplying the total number of employed workers by labor productivity. To get individual firms' output, total GDP is divided by the number of firms in the economy: following Caiani, Godin, Caverzasi, Gallegati, Kinsella, and Stiglitz (2016) initialization procedure, it is assumed that k-firms are 1/5 of c-firms and consequently production in the k-sector is 1/5 of production in the c-sector as well as employees.

K-sector

By dividing the wage rate by labor productivity, one can get to the unit cost, which is exactly equal to the price charged by k-firms (i.e. in s.s. the murk-up charged by k-firms is nil). Liquidity (i.e. k-firms' deposits) is a fraction of wages paid to workers. Proceeding as in Caiani, Godin, Caverzasi, Gallegati, Kinsella, and Stiglitz (2016), given the real stationary state, k-firms' production exactly coincides with the quantity of worn out intangible capital of c-firms that need to be replaced. All output that is produced is assumed to be sold (supply=demand), therefore initial inventories are set to zero. Assume also for simplicity that in s.s. every firm has no need of external financing, so that loans=0. Profits, being revenues minus wages end up to be nil as well (which is in line with the assumption of perfect competition). No dividends nor taxes are paid as a consequence.

C-sector

The nominal value of intangible capital is calculated by multiplying the quantity of intangible capital by the price of intangible capital and, together with the endowed physical capital and initial liquidity, constitutes c-firms' equity. Again, inventories, profits, taxes, dividends and loans are zero.

Rest of the economy

Workers' wealth is obtained by multiplying the wage rate by the total number of workers[41], while capitalists' wealth is zero. Because the economy is in a stationary state, real consumption corresponds to c-sector's total output.

[41] Workers also pay taxes on their income, raised by the Government.

E.5 - Parameters Value

Parameters	Description	Values
Fc	n. of c-firms	100
Fk	n. of k-firms	20
W	n. of workers	1800
Z_c	n. of interactions in consumption good market	2
Z_k	n. of interactions in capital good market	2
Z_e	n. of job applications	5
Z_b, Z_bk	n. of interactions in the bonds' market	20,100
ξ^{hw}	memory parameter human wealth	0.76
χ	fraction of wealth going to consumption	0.05
ν^Y	c-firms' quantity adjustment parameter	0.9
ν^K	k-firms' quantity adjustment parameter	0.9
$\mu_{j,0}$	initial k-firms' mark-up	0.0001
$(\mu_{FN_k}, \sigma^2_{FN_k})$	k-firms' folded normal distribution parameters	(0,0.01)
$\mu_{i,0}$	initial c-firms' mark-up	0.2
$(\mu_{FN_c}, \sigma^2_{FN_c})$	c-firms' folded normal distribution parameters	(0,0.01)
$a^{\kappa}_{f,0}$	initial k-firms' labor productivity	0.66667
$A_{j,0}$	initial entailed capital productivity	0.33333
ϕ^L	fraction of bank debt principal repayment	0.05
r	general refinancing rate	0.015
τ^{Div}	firms' dividends' payout ratio	0.3
δ	intangible capital depreciation	0.0667
ξ^{κ}	memory parameter in the capital utilization rate	0.5
γ	probability of investing in new intangible capital	0.5
B^{pv}	bonds' par value	1
$\bar{z}$	R&D effort	0.03
ϵ	fraction of R&D devoted to innovation	0.5
$\zeta^1_{j,0}$	initial learning, innovation	0.45
$\zeta^2_{j,0}$	initial learning, imitation	0.45
$(\alpha_x, \beta_x$	Beta distribution parameter	(3,3)
$[\underline{x}, \bar{x}]$	support interval (Beta distribution) for capital productivity	[-0.15,0.15]
$[\underline{x}, \bar{x}]$	support interval (Beta distribution) for labor productivity	[-0.15,0.15]
b^{phy}, b^{rd}	capital factors distribution	0.5, 0.5
σ	elasticity of substitution	0.5
μ^L	bank's mark-up	1.2
t^w	tax rate on wage income	0.04
t^{π}	tax rate on firms' and bank's profits	0.04

F.6 - Autocorrelations and Lagged Correlations of Selected Variables

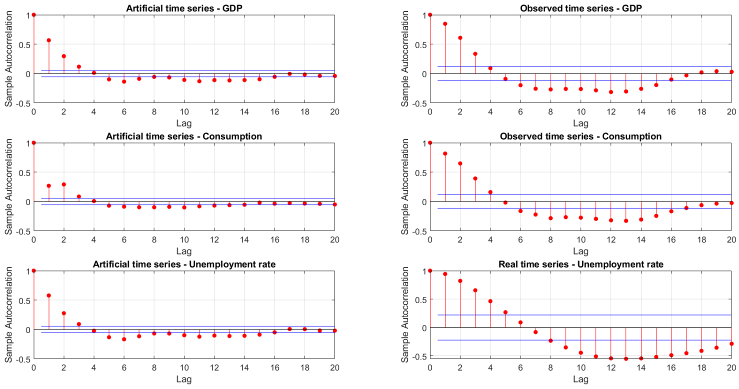


Figure 10: **Autocorrelations.** Artificial time series of 15 Monte Carlo simulations, averaged out (left) and observed time series (right).

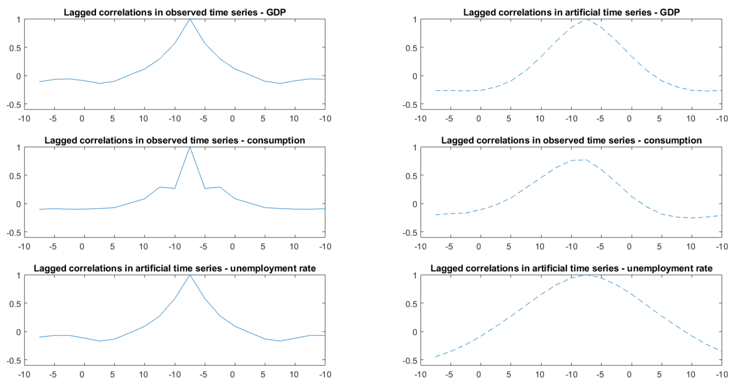


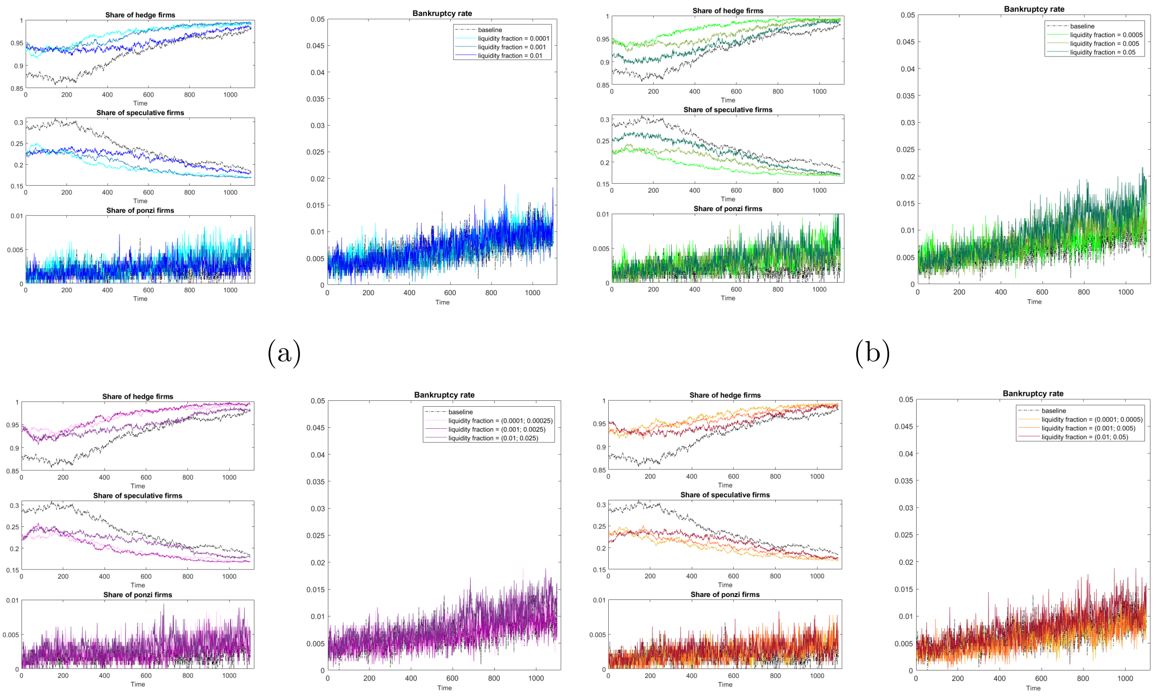
Figure 11: **Lagged correlations.** Artificial time series 15 Monte Carlo simulations, averaged out (left) and observed time series (right).

G.7 - Significance of the Experiments: Two Sample Test

Table 8: **Two sample tests to test the significance of selected variables (real GDP, unemployment rate, technological frontier and bankruptcy rate) and experiments. Averages over 15 Monte Carlo runs are displayed, as well as standard deviations (in parenthesis). The star besides the average value indicates the significance at 5%.** Experiments involving $\tau^B = 0.0001$ and $\tau^B = 0.0005$ are not reported but display the same significance as those with $\tau^B = 0.001$ and $\tau^B = 0.005$.

	GDP	**Unempl. rate**	**Tech. frontier**	**Bankr. rate**
Baseline model	2643.5568 (331.1599)	0.0975 (0.0038)	0.7511 (0.1436)	0.0060 (0.0014)
Exp.1: $\tau^B = 0.001$	2423.9808* (199.4849)	0.1086* (0.0094)	0.6891 (0.1117)	0.0058 (0.0013)
Exp.1: $\tau^B = 0.01$	2467.9243 (182.5943)	0.0990 (0.0047)	0.6897 (0.0968)	0.0064 (0.0013)
Exp.2: $\tau^B = 0.005$	2558.3460 (240.7114)	0.1060* (0.0084)	0.7625 (0.1505)	0.0070 (0.0014)
Exp.2: $\tau^B = 0.05$	2962.2028* (440.5952)	0.1025* (0.0081)	0.9421* (0.2376)	0.0084* (0.0025)
Exp.3: $\tau^B = (0.001; 0.0025)$	2413.4905* (141.3988)	0.1083* (0.0080)	0.6864 (0.0847)	0.0060 (0.0013)
Exp.3: $\tau^B = (0.01; 0.025)$	2651.7316 (453.7276)	0.1031* (0.0083)	0.7936 (0.2108)	0.0078* (0.0020)
Exp.4: $\tau^B = (0.001; 0.005)$	2362.5295* (194.028)	0.1038* (0.0097)	0.6730 (0.1281)	0.0057 (0.0018)
Exp.4: $\tau^B = (0.01; 0.05)$	2556.7630 (270.5399)	0.1011 (0.0057)	0.7400 (0.1568)	0.0073* (0.0020)

H.8 - Bankruptcy Rates and Financial Position of the Economy



(a) (b)

(c) (d)

Figure 12: **Bankruptcy rate and financial position of the economy. All experiments.**

I.9 - Wages and Inequality

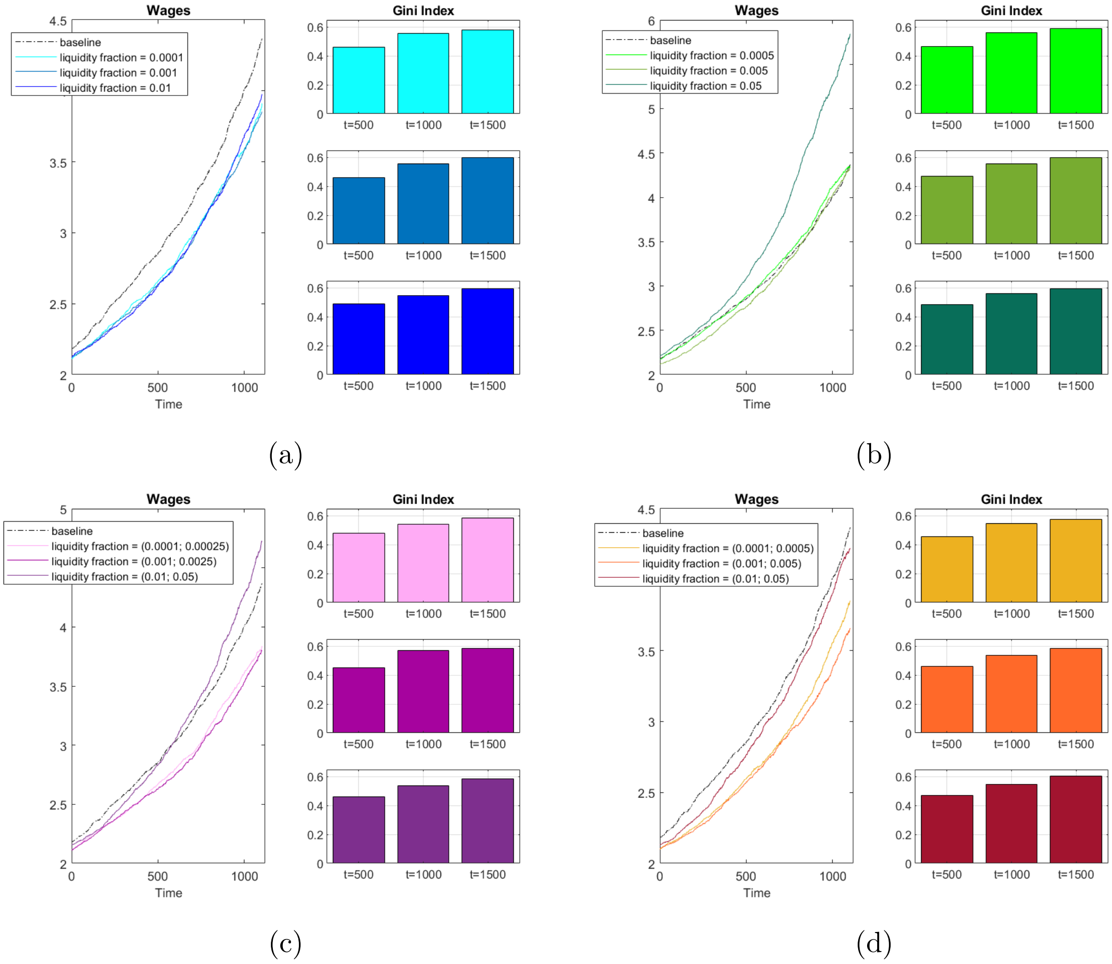


Figure 13: **Wages and Gini index. All experiments.**

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